DOCUMENT RESUME

ED 198 007 SE 034 300

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TITLE Investigation and Action Skills for Environmental Problem Solving. A Curriculum Development Project Designed to Promote Autonomous Problem Solving in Environmental Education, Modules I-VI. Student Edition and Teacher's Edition.
REPORT NO ISBN-87563-150-9
PUB DATE 78
NOTE 229p.; Contains occasional light and broken type.
AVAILABLE FROM Stipes Publishing Company, 10-12 Chester St., Champaign, IL 61820 (no price quoted).

EDRS PRICE MF01/PC10 Plus Postage.
DESCRIPTORS *Citizen Participation; *Community Action; Environment; *Environmental Education; Junior High Schools; Problem Solving; Research Skills; Science Education; *Social Studies; *Student Projects; Values Clarification
IDENTIFIERS *Environmental Problems

ABSTRACT

Presented are six modules designed to help junior high school students develop the skills needed to study and take action with respect to environmental problems. The first five modules cover basic investigation skills: identifying environmental problems, using secondary sources, conducting surveys, interpreting data, and studying environmental problems. Module VI offers various strategies and activities for both surrogate and real environmental action planning. Values clarification exercises and class discussions provide the opportunity for students to analyze conflicting viewpoints, while objectives listed in each module inform students about the competencies they will develop. The teacher's edition, which is appended to the student materials, contains background information and guidelines for facilitating the learning experiences. (WB)

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ED198007

Investigation and Action Skills for Environmental Problem Solving

A Curriculum Development Project Designed to Promote Autonomous Problem Solving in Environmental Education

MODULES I - VI

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ISBN 87563-150-9

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Published by
STIPES PUBLISHING COMPANY
10 - 12 Chester Street
Champaign, Illinois 61820

SE 034 300

PREFACE STATEMENT

The six modules in this instructional sequence are specifically designed to train students in the skills of environmental issue investigation and action. They are also designed to permit students to apply these skills to issues in which they are personally interested.

The modules should be usable at any grade level, 6 - 10, with normal populations of students. Additionally, because the modules are designed to get students involved in actual problem solving situations, they are recommended for use with gifted populations as well. The inquiry or investigation strategies used in the modules are in keeping with current recommendations for both regular and gifted education.

The teacher using these modules should be both competent and dedicated because they are not for the faint-of-heart. They necessitate a teacher fulfilling several different roles - a situation somewhat difficult for certain instructor-types. The teacher engaging students in these modules must be an empathetic leader, a group dynamics advocate, a facilitator, a research consultant, and a believer in autonomous learning. Above all, he/she must be both patient and demanding - insisting humanistically that students strive for criterion performance - using their total talents in an effort to help resolve environmental problems.

These straight-forward comments are predicated on the belief that teaching is a serious and critically important persuit. There is no effort here to attempt to delude readers into thinking that these modules provide a panacea for environmental education. Indeed, they do not! However, they do serve a critically important need in environmental education. Few skills are as important from a general education perspective as those developed in these modules. The writers applaud those teachers who are dedicated to providing a genuinely sound general education from an environmental standpoint. These modules are simply one tool to facilitate that persuit.

Harold R. Hungerford
Ralph A. Litherland
R. Ben Peyton
Audrey N. Tomera

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Where are we going? What is the nature of the problems we face? What is our individual responsibility for . . . preserving our life-support system? Let us begin to look more deeply into these complex questions so that we may then convert our understanding into effective individual and group action.

G. Tyler Miller, Jr.

ACKNOWLEDGMENTS

These modules represent a radical departure from typical paradigms for environmental education. Because of this, no definitive guidelines existed to guide the developers in the production of a curriculum that met their criteria - a program which would help middle school students become autonomous investigators of environmental problems and teach them the rudiments of environmental action strategies. This set of circumstances resulted in a development phase of nearly five years during which three editions of the modules were produced and evaluated.

A project of this type necessitates the incorporation of many skills. Many people have given both time and skills willingly in an effort to help the developers reach their goals. Trial teaching efforts by Floyd Waggoner, Larry Tate, R. Henry Bisaga, and Donna Childers contributed measurably to an evaluation of earlier editions. Equally important were the suggestions tendered by both John Disinger and Tom Tanner with respect to the action portion of this program.

J. Ronald Gardella contributed both his artistic talents to earlier editions and his educational expertise as he supervised the trial teaching of the second edition in New Jersey middle schools.

Several research studies were conducted to measure the effectiveness of the modules to generate both cognitive knowledge and values. Floyd Waggoner, Henry Bisaga, and John Ramsey invested heavily in these efforts and their contributions are appreciated. William Bluhm was also involved significantly in data collection and his effort contributed greatly to the success of these research studies.

Also involved in other dimensions of the development process were Henry Frazier, Barbara Litherland, Pat Hungerford, and Suzanne Hungerford. And, when the developers were responsible for taking the modules to workshops and institutes they were assisted, at one time or another, by dedicated professionals like Gary Harvey, Rick Wilke, Ron Gardella, and John Ramsey.

To all of the above - and many others - the authors owe a sincere debt of gratitude. Without their help these modules would not be available.

January 10, 1978

MODULE I

LOOKING INTO ENVIRONMENTAL PROBLEMS

Introduction

Most students today get "turned on" about problems in the environment. This may be true because YOU are A PART of the environment. Since its the world YOU live in, YOUR environment becomes rather important. You must have air to breathe, food to eat, water to drink, clothes to wear, and somewhere to live. A lot of students, however, have gotten the idea that this isn't quite enough. They think that the air and water should really be clean. The food should be safe to eat and it should taste good. The house or apartment should be safe and comfortable. Yes, maybe even there ought to be a tree close by and a squirrel to watch and an owl to listen to at night. Some students are also worried about what the condition of the earth will be like when their children are growing up. How do YOU feel about these things?

In Module I we will begin taking a close look at environmental problems. This module should help give you a better understanding of the environment and its problems. Further, it is designed to help you identify environmental problems and inspect different human values and the role they play in producing environmental problems. You will also be asked to become skilled in classifying environmental problems in certain problem situations.

You will find specific instructional objectives for Module I on the next page. Always read the objectives carefully before beginning work in a module. In this way you will always know what is expected of you before you begin.

Objectives for Module I

As a result of interacting with Module I, you will be expected to . . .

I-1. . . . identify yourself as an individual human being in a manner that separates you from all other human beings.

I-2. . . . prepare a written description of a human being in a manner that would allow someone who is unfamiliar with that person to identify him/her.

I-3. . . . successfully prepare a set of written instructions giving directions on how to proceed from Point A to Point B using a map.

I-4. . . . communicate your definition of the term "environment".

I-5. . . . list at least six interactions that take place between you and your environment.

I-6. . . . prepare and communicate a list of at least ten environmental problems.

I-7. . . . restate at least five of the problems in I-6 in question form.

I-8. . . . successfully explain why at least two of the problems stated in I-7 can be considered to be environmental problems.

I-9. . . . identify and communicate two different value positions for items in a set of classroom situations where differing student values exist.

I-10. . . . identify and communicate two different value positions for items in a set of at least six environmental problems chosen by you.

I-11. . . . define the term "environmental problem".

I-12 - I-13. . . . using information concerning the skill of classification, accurately group twenty environmental problems into each of four assigned categories.

I-14. . . . logically defend a portion of the classification scheme produced in I-12 and I-13 above.

I-15. . . . using information about ways of investigating environmental problems, reclassify the original problems in terms of how they can be attacked for study.

I-16. . . . after reading a description of an environmental problem, correctly identify problem questions that apply to that situation from a list presented to you.

I-17. . . . after reading a description of an environmental problem, identify and communicate problem questions that are consistent with that problem.

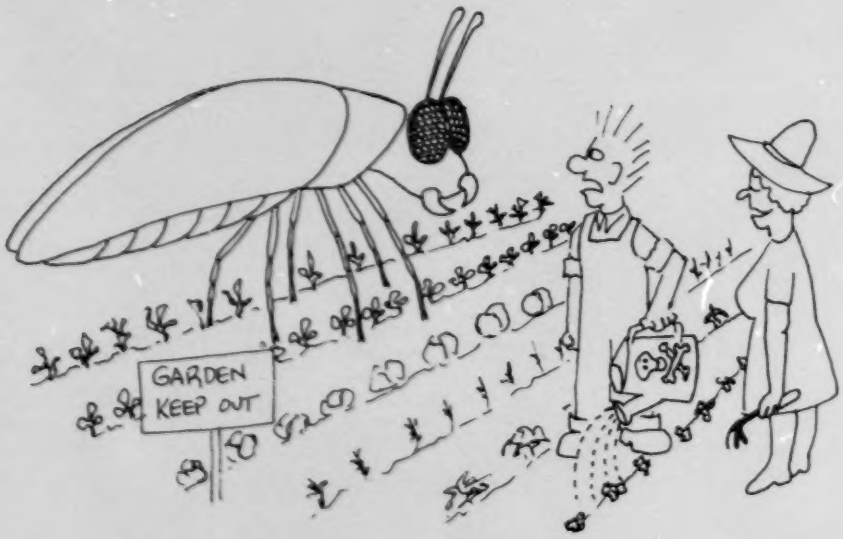
Getting Started

What's this all about anyway? What's the business about "looking into environmental problems"?

The business we are about is you - the environment - its problems - and your being able to take a hard look at an environmental problem that YOU choose to do research on.

Many teachers would like to see students able to study subjects or problems in which the students are interested. And, this is very true in the area of environmental education. This field is so important and there is so much to learn that it would be great if students could really dig in and investigate problems they choose - THEMSELVES!

There are lots of good things that could come from this. One is simply that most students enjoy working on problems they choose for themselves. Another plus is that students could wind up helping each other learn about many different environmental problems. An important fact, however, is also connected with learning about something first-hand. When you learn something first-hand, you remember what you have learned for a long time and it is more meaningful to you. Most important, if you learn HOW to investigate a problem



DARN IT FRED! I WARNED YOU NOT TO USE ALL OF THOSE CHEMICAL PESTICIDES!!!

well, you should have skills you could use by yourself with a wide range of different problems.

The secret is to learn how to dig into problems in a scientific manner. In this way there is a big pay-off for you. For the first few weeks, then, we are going to help you become a skilled investigator. As soon as you have convinced your instructor that you are ready, you will be turned loose to investigate environmental problems on your own - checking in once-in-awhile so you can report on your progress.

I-1. Let's Communicate.

If you observe something - or know something - how do you tell someone about it? Sure, you tell that person what you want him to know. How do you do it? Do you SPEAK to him - do you WRITE it out - do you DRAW it - do you ACT it out? Any of these ways work at certain times. But, how well do you communicate what you want someone to know?

Communication - even with language, and drawings, and acting - is very difficult for many people. Think about rumors for a minute. How many times does something have to be told before the story changes completely? Often, it doesn't take very long for a rumor to change tremendously. This is probably because of poor communication skills between the people exchanging the rumor.

Let's see if we can improve your communication skills. Who are you? Identify yourself below in writing.

_____

How well did you do? Did you record your full name or did you leave something out? For example, George Johnson is not nearly as well identified as George F. Johnson. George F. Johnson is not as well identified as George Felix Johnson even if George hates the name Felix. Now, if George Felix Johnson really wants to identify himself WELL he will write his name Mr. George Felix Johnson. If he has a Social Security Number he can add this after his name to make certain that he will not be confused with another George Felix Johnson.

You might laugh but you were asked to identify yourself. Want to try it again, below? There might even be another good way you can think of.

I-2. Another Communication Task.

Suppose you needed to identify someone in your class to another person who did not know this student well or at all. Pretend, for example, that he/she was flying to Australia on a 747 jet and someone there had to quickly recognize him/her when the student walked off the plane. How could you write a good description of this person to your contact in Australia? Try it below and DO NOT use clothing (except glasses) in your description.

Be sure to communicate clearly. When you are done, read your description to the class and see if anyone can tell you who you wrote about. Does the person described recognize the description himself/herself?

"UNPOLLUTED"

How well did you do? Are your classmates able to identify this person? Can a stranger identify him/her? If not, you need to work further on this particular communication task.

I-3. Giving Directions.

Another way to test your ability to communicate is to see how well you can give directions. On the next page is a map of Reed City. You live on Locust Street between Polk Street and Kennedy Street. A stranger comes to your door and wants to know how to get to Moss Woods. The stranger lives in another town and has never been to Reed City before. How would you tell him how to get to Moss Woods - accurately? There are several possible ways. Try your skill below. You CANNOT draw a map for him.

Directions: _____

_____

_____

_____

_____

_____

_____

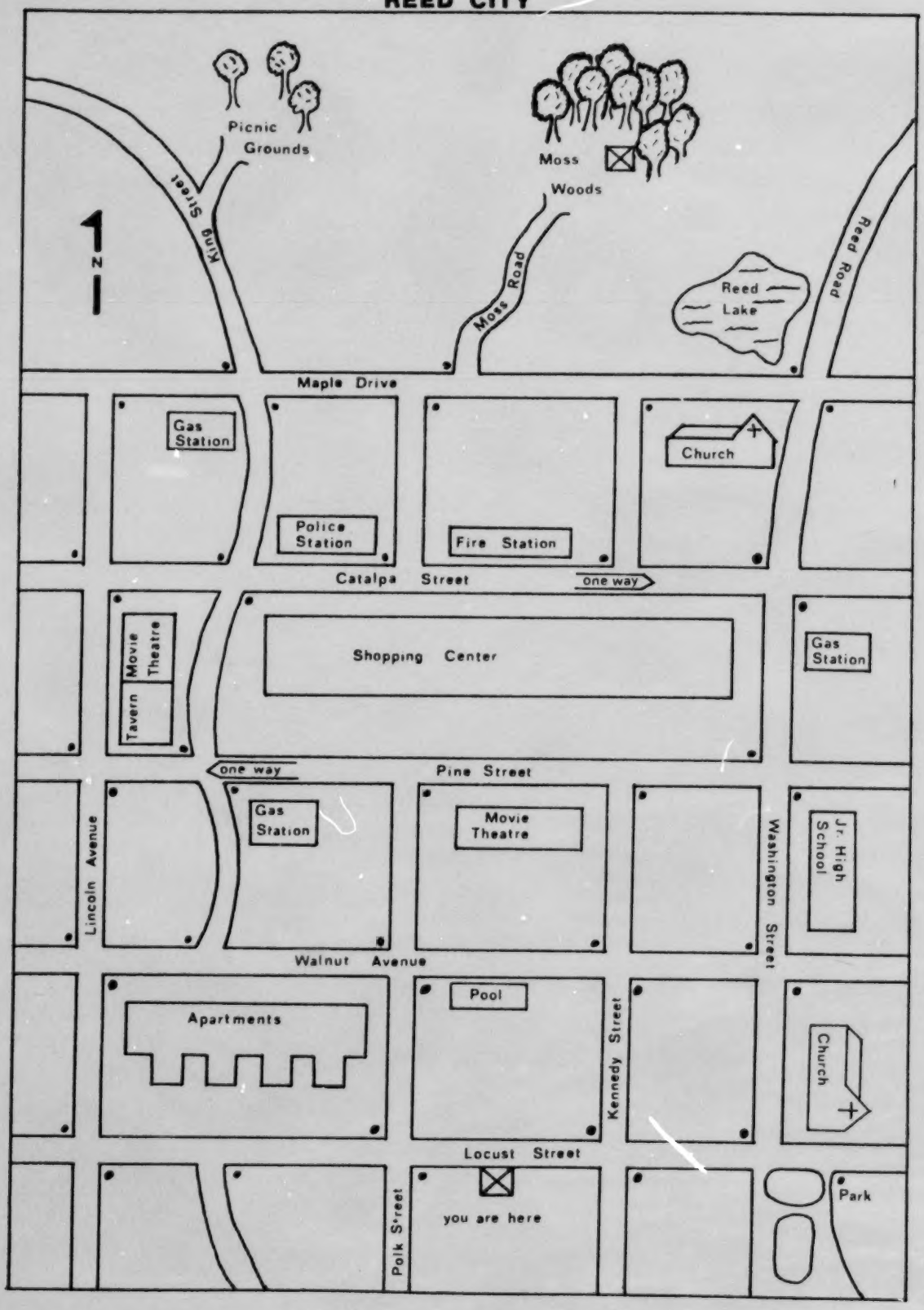
_____

_____

_____

How well did you do? Are your directions clear? Are they accurate? Could the stranger really find his way to Moss Woods? If not, you might want to try this task again on a separate sheet of paper.

REED CITY


Picnic Grounds
King Street
N
Moss Woods
Moss Road
Reed Lake
Reed Road
Maple Drive
Gas Station
Police Station
Fire Station
Church
Catalpa Street
one way
Movie Theatre
Tavern
Shopping Center
Gas Station
one way
Pine Street
Lincoln Avenue
Gas Station
Movie Theatre
Washington Street
Jr. High School
Walnut Avenue
Apartments
Pool
Kennedy Street
Church
Locust Street
Polk Street
you are here
Park

Communication is a very important skill in almost all things that human beings do. If it is done poorly, the results can be tragic. And, they often are. If you - or your instructor - think that you need more practice in communicating, there are many things that you can do to get practice. Three of these are found below:

1. Reed City Rapid Fire. You will need a partner. Pick two points in Reed City, one the starting point and one the destination. Ask your partner to describe how to get there using the most direct route. Evaluate your partner on accuracy and speed.

2. Describing a Picture. Write out a description of a picture or photograph. Write it so accurately that someone who had never seen it could point to it when it was placed in a large group of similar pictures or photographs.

3. Which Way Home? Can you tell someone exactly how to get from where you are sitting right now to the front door of your house or apartment? Try it. See if people understand your instructions. Have someone who knows where you live help you judge the quality of your directions.

Piece By Piece

If we are going to eventually use our communication skills with environmental problems, we had better make sure we understand what environmental problems are.

Do you know what "environment" is? How good a definition can you write for "environment"? In the space below, write a definition of the term. (I-4)

ENVIRONMENT: _____

_____

_____

_____

_____

Now, your instructor may have several of the students in class read their definitions. While this is being done, think carefully about these definitions and how they are alike and how they differ. Also, try and decide whether you

think they are correct. Below is also a list of questions for you to think about as these definitions are read:

1. How many students identified or described things (factors) in the classroom as part of the environment?

2. How many students identified or described factors in the community or region where they live?

3. How many students said that EVERYTHING around them was the environment?

4. How many students included the way they affect or are affected by things around them?

One of the really important factors in an organism's environment is the INTERACTION between it and objects or events in the environment. An interaction simply deals with how living and/or nonliving things influence each other. For example, you breathe and take some of the oxygen out of the air to stay alive. This is an interaction between your body and the atmosphere. Plants use the sun's energy, water, and carbon dioxide to make food. They give off oxygen.

Many interactions between you and your environment are complex. Suppose you go into your favorite fast food outlet and buy a hamburger and a milkshake. Where are the interactions between you and your environment here? First of all, an animal was killed to produce the hamburger meat for you. That animal had to be grown and processed and all of this takes energy. The meat had to be cooked. This consumed either gas or electricity. The paper products in which the food came were produced from trees. The trees had to be processed. More energy! After eating the food, you will put heat and carbon dioxide back into the environment. If you should throw the waste paper in the street or on the sidewalk you are polluting the environment. Actually, these are not the only interactions when you buy that hamburger and milkshake. But, you should begin to get the picture.

In what other ways do you interact with your environment? Below, you are asked to list six interactions that take place between you and your environment. (I-5)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Now, just what IS the meaning of "environment"? Write a definition or description of "environment" on a separate sheet of paper. This will be turned in to your instructor so he/she can see how well you understand this term. Following this, your instructor may ask your help in producing a class definition of "environment" that can be posted in the room as a permanent reference.

What Are Environmental Problems?

Now that you have some idea as to the meaning of environment, you should be able to begin coming to grips with the ideas connected with environmental problems. But, please do not laugh this off as a simple matter. Indeed, it is not!

First of all, you can probably list several problems in the environment. This would be a good place to begin. Try listing several below. Do ten (10) if you can. Three have already been listed for you so you can get some idea as to how to go about it. If you are still having trouble after a few minutes have a conference with your instructor.

(I-6) Environmental Problems: My List.

Example: To what extent should nuclear energy be used at this time to produce electricity on a large scale?

Example: What are the environmental issues which result from using chemical pesticides for insect control?

Example: What ecological problems are produced by feral (wild) dogs and cats?

1. _____

_____.

2. _____

_____.

3. _____

_____.

4. _____

_____.

5. _____

_____.

6. _____

_____.

7. _____

_____.

8. _____

_____.

9. _____

_____.

10. _____

_____.

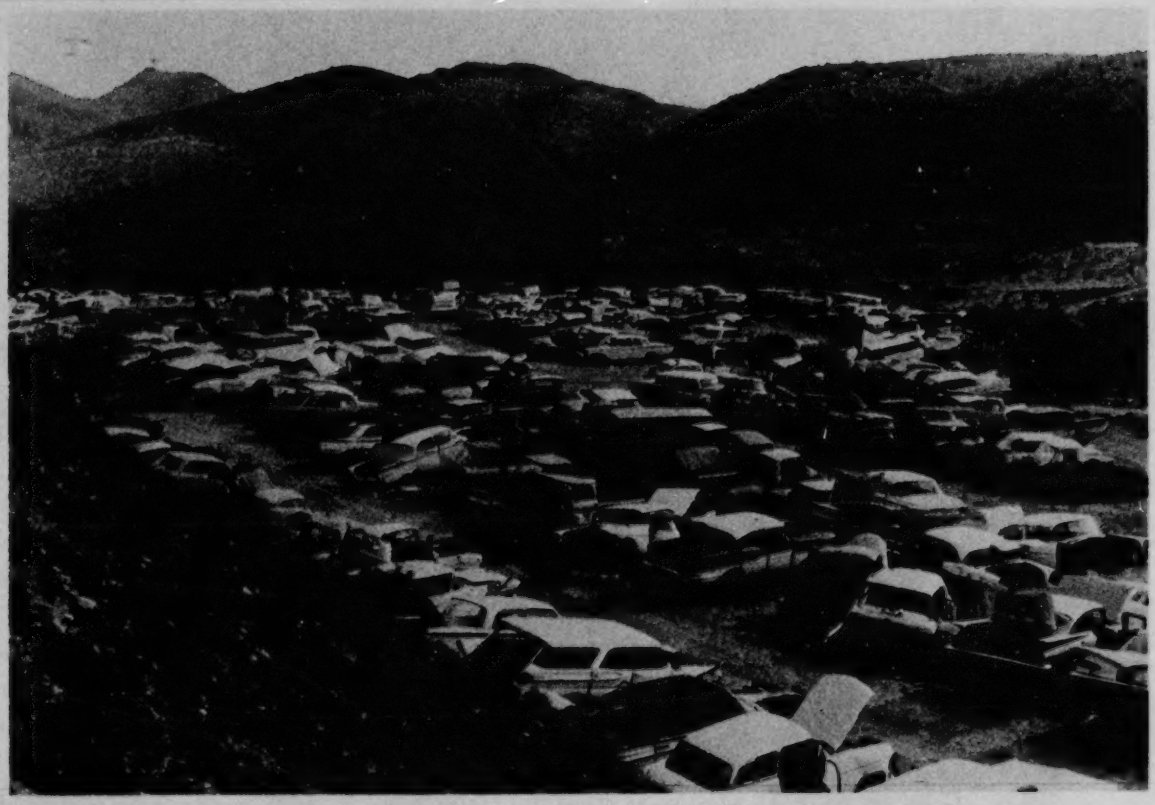
How many of your problems did you list as questions? This is a good way to do it because, with environmental issues, there is often no one right or wrong answer. Often, many different answers seem to exist.

Illegal Dump in an Abandoned Strip Mine. (Photo courtesy Harold R. Hungerford).

Many serious environmental issues are seen in this photo. Even though new strip mine legislation guarantees that scenes like this will not be common, many abandoned strip mines scar the landscape in coal producing regions. It is also tragic that many people believe that these areas are public garbage dumps. This illegal dump is not only unsightly, it helps render the water unsafe for any use. An immense amount of metal rests here in the damp Midwestern air - metal that could be recycled and used again. In 1976 the trash heap of the United States included the following:

Cans:	17,000,000,000
Jars and Bottles:	38,000,000,000
Tons of Plastic:	4,000,000
Television Sets:	7,600,000
Cars and Trucks:	7,000,000
Tons of Paper:	35,000,000

What is the waste situation in YOUR community? Are there any environmental problems associated with waste disposal there? Is any of the waste recycled? If not, why not? Investigate the situation and find out. (Waste data from the September 1976 issue of Audubon.)

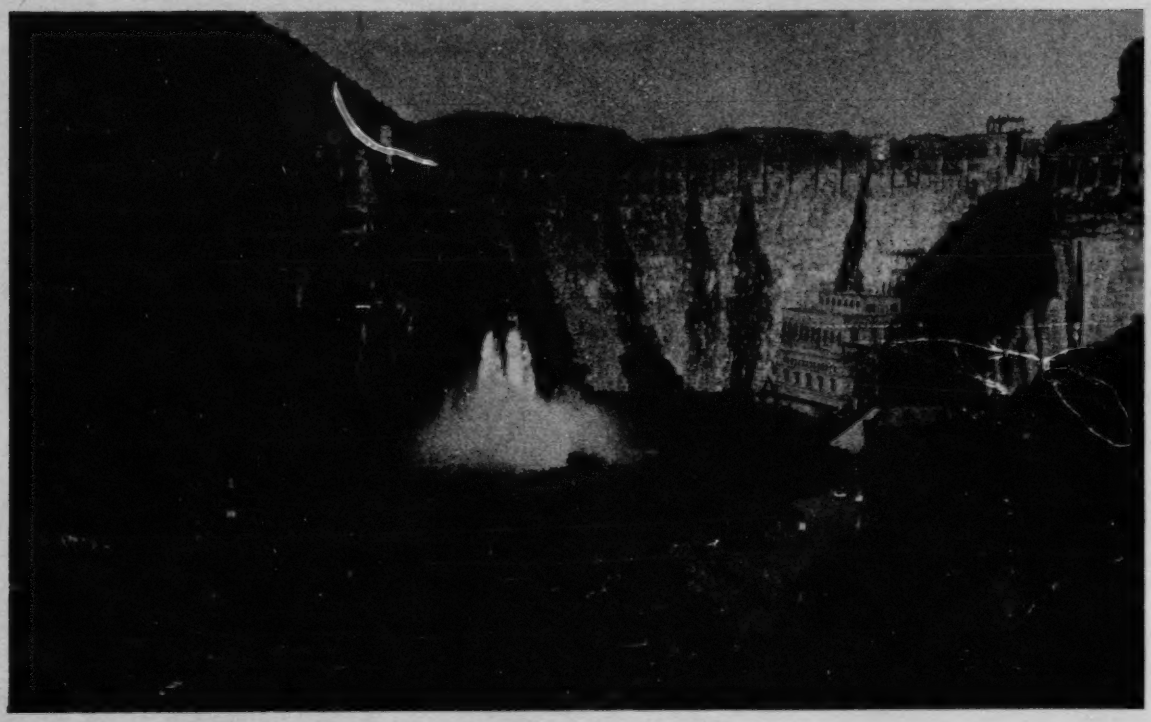


Automobile Graveyard in Arizona. (Photo courtesy Harold R. Hungerford.)

Few, if any, regions in the U.S.A. are without their auto graveyards. Not only are junked and abandoned cars unsightly, they take up space on the planet that could be used more wisely. Perhaps of greater concern is the fact that these autos, vans, and trucks represent a tremendous resource in steel that could be recycled. A 1977 study shows that the U. S. has 636,000,000 tons of discarded iron and steel. And, for each ton of scrap steel and iron that is recycled, 1.5 tons of iron ore and 700 pounds of coal are SAVED. How many junked cars and trucks show up in fields and vacant lots where YOU live? Are old autos recycled in your region? If not, try to investigate the reasons for this lack of conservation. (Tonnage data from the Fall 1977 issue of the Phoenix Quarterly.)

Flooded Homes on the Des Plaines River in Illinois. (Photo courtesy of the U.S. Soil Conservation Service.)

Wise planning and land management could have prevented this costly tragedy. Flood plains should not be used for housing or industrial development. To prevent further damage to these homes, the river might be dammed or channelized (deepened). However, these actions only create more complex environmental problems by producing more floods downstream, increasing sedimentation and erosion, and eliminating many kinds of wildlife. How should flood plains be used by man? How can concerned citizens convince people that misuse of flood plains creates environmental problems? Do land use problems similar to this exist in your area? If so, why? What might be done about them?



Midwestern Coal Strip Mine. (Photo courtesy Harold R. Hungerford.)

In the United States hundreds of millions of tons of usable coal lie between 50 and 100 feet beneath the surface of the land. These coal reserves are available to surface or strip mining. In this scene you can see the huge stripping shovel that removes the soil and rock from above the coal. In the background can be seen the small shovel used to remove the coal itself. In strip mining, the surface of the land is changed a great deal. Even with strict reclamation practices much of the land will never be as productive as it once was. However, with the demand for coal increasing, more and more land will be mined in this way. By 1985, experts believe that 4,700 square miles of land will be stripped. This is an area twice the size of the state of Delaware. Even though more and more mining laws are being passed, environmental problems remain. Try to list some of the possible issues that could be raised.

Roosevelt Dam - Arizona. (Photo courtesy Harold R. Hungerford.)

Few issues raise as many questions as does the damming of streams and rivers. There are those who are violently against damming natural waterways and those who are very much in agreement with this practice. On one hand, dams can be used for water storage, flood control, and the generation of electricity. Also, certain kinds of recreation are promoted by the lake that forms behind the dam. On the other hand, hydroelectric power can provide only a limited amount of electricity in the U. S. And, where a dam is built, the flow of the stream is sharply affected. Many plant and animal species are harmed. Also, in time, silt will fill the reservoir behind the dam, destroying the lake and its recreational value.

Aerial Photo of Chicago, Illinois. (Photo courtesy of Harold R. Hungerford.)

Well over 1000 square miles of land along the southern tip of Lake Michigan is covered by residential, business, and industrial developments similar to this portion of Chicago. The use of the land, air, and water by so many people creates many environmental problems. For example, what do you think causes the haze in the air even on such a clear day as this? Would you consider this haze to be an environmental problem?

This city may seem to be largely independent. Yet, it must be provided with food, electrical and fossil fuel energy sources, water, and a waste disposal system. What environmental problems can you think of that might be caused by taking care of these needs? What effects do you think living and working in this metropolitan area might have on the behavior of people? Could crime be a serious problem? Would you consider this to be an environmental problem? Why? Why not?

Intersecting Superhighways Near Chicago. (Photo courtesy of Harold R. Hungerford.)

Many environmental problems could be posed from this picture, but most of them concern land use. This scene represents a typical "urban sprawl" which develops outside the limits of large cities. Notice the clustered neighborhoods and large open spaces between. Does this development pattern make the most efficient use of space? What problems can you identify that could arise concerning the use of the automobile, the cost of supplying utilities, and land values? Many people built homes in this area because the highways provided fast, easy access to the city. As more and more subdivisions are developed along the highways, what will be the effect on the people who use it to commute to the city each day?

Can you identify similar environmental problems in your own area? See if you can find an agency responsible for planning the use of land for both housing and industrial developments. What are its policies? Are they environmentally sound?

Did you list your problems as questions? If you didn't list your problems as questions, it might be a good idea to pick out four or five of your problems and restate them as questions. Do this below.

(I-7) Environmental Problems in Question Form.

Example: Are ranchers justified in killing eagles because they think that these birds of prey kill livestock?

1. _____

_____?

2. _____

_____?

3. _____

_____?

4. _____

_____?

5. _____

_____?

Now, you have a new task to complete using your list of problems. Choose any two of the problems you listed and briefly (but accurately) tell WHY this is an environmental problem. You are to write your explanations below. Please write down your own ideas as to why these are problems - do not worry about whether your ideas are 100% accurate right now. (I-8)

Problem: _____

Why this is a problem: _____

_____

_____.

Problem: _____

Why this is a problem: _____

_____

_____.

Now, check carefully for two things with your problems and your explanations of why these are problems. First, the problem questions should be clearly stated. Are they? Second, the explanations should somehow show that people do not agree on the solution to the problem. Sometimes they do not even agree that there is a problem at all.

In the case of using nuclear energy for the production of electricity, there is sharp disagreement as to the safety factors involved in putting nuclear plants close to large numbers of people. Second, there is disagreement as to how wastes from these plants should be discharged. In short, some people firmly believe that nuclear power is not an environmentally safe energy source.

In the case of ranchers killing eagles because they think that they destroy live domestic animals, there are those who disagree violently. Many are concerned about these birds becoming extinct. Further, ecologists point out that the belief that hawks, owls, and eagles take large numbers of live domestic animals is sheer nonsense.

So, in both of these cases there is differing opinion. It is quite important for you to understand that human beings' positions differ on environmental questions and that often these positions differ a great deal!

Now, we are getting down to the nitty-gritty of the thing. When we say that one group has one position and another group has another position, we are talking about people having different VALUES. VALUES are opinions in which people believe and on which people act.

The business of values is the heart of the matter when it comes to environmental problems. Different opinions - or VALUES - create these problems.

Let's chart just a few of these different values for specific problems. Please keep in mind that there are often MANY DIFFERENT VALUES regarding one particular problem. Here, however, we see only two sides to a particular question.

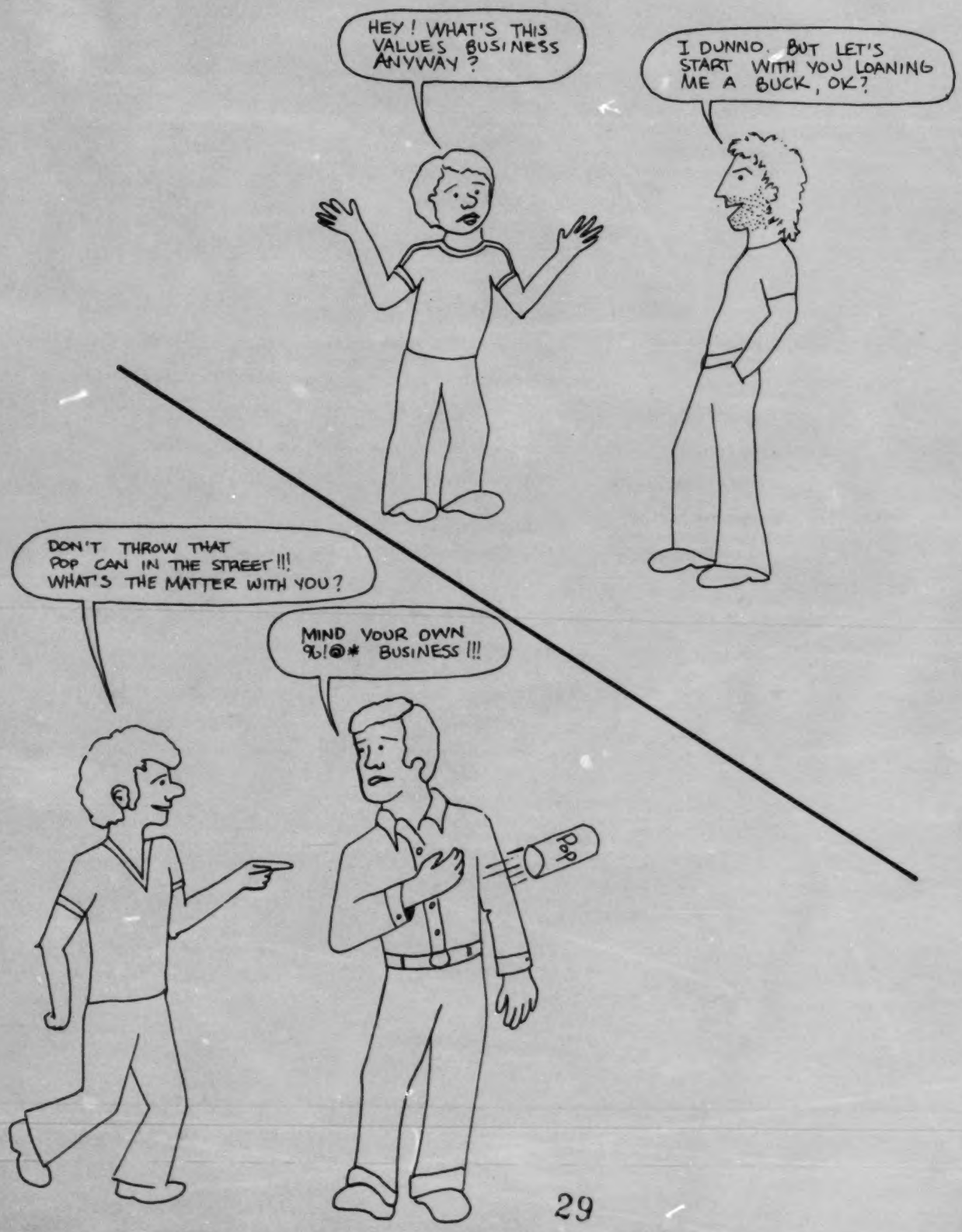
ONE SET OF VALUES		THE QUESTION		ANOTHER SET OF VALUES
Drop it anywhere.	-----	Waste paper?	-----	Dispose of it where it cannot become litter.
Buy it in any container.	-----	Pop?	-----	Buy it only in reusable containers.
Shoot them.	-----	Blue birds?	-----	Build and install blue bird nest boxes.
Write on them.	-----	Washroom walls?	---	Keep them clean.
Buy things in them.	-----	Plastic containers?	-----	Refuse to buy things in plastic containers.
Who cares?	-----	Water conservation?	-----	Use as little as possible when in short supply.
Controlled hunting.	-----	Deer?	-----	Total protection.

In almost every kind of situation, values are operating to help people decide what to do. Let's take your own classroom as an example. Not all students have the same values about decision-making in the classroom. What are some of the differing values that might operate in your own classroom? This might be a tough task but let's see how well you can identify different students' values concerning a number of things in the classroom.

Write in the blanks below those values that might be operating in your own classroom (or school): (I-9)

ONE VALUE POSITION		THE QUESTION		DIFFERENT VALUE POSITION
_____	---	Theft?	---	_____
_____	---	Cheating on tests?	---	_____
_____	---	Vulgar language in class?	---	_____

VALUES


HEY! WHAT'S THIS VALUES BUSINESS ANYWAY?
I DUNNO. BUT LET'S START WITH YOU LOANING ME A BUCK, OK?
DON'T THROW THAT POP CAN IN THE STREET!!! WHAT'S THE MATTER WITH YOU?
MIND YOUR OWN %!@* BUSINESS!!!
POP

_____	---	Your teacher's rights?	---	_____
_____	---	Your teacher's responsibilities?	---	_____
_____	---	Student rights?	---	_____
_____	---	Student responsibilities?	---	_____
_____	---	Treatment of library books?	---	_____

Few of the above are usually considered to be environmental problems. Still, people deal with other human beings in many different situations. Is this not, then, a part of a human's environment? If people have faulty values and are eventually destroyed by them what good is there worrying about other environmental problems? It's an interesting question to think about.

Now, let us permit YOU to choose environmental problems and look at differing values for them. Perhaps you will want to go back and take a look at the list you completed earlier. Or, you might want to think of new problems to list. In any event, list six (6) environmental problem topics in the center column below and write differing sets of values in the column to the left and the column to the right. (I-10)

ONE SET OF VALUES		THE PROBLEM		ANOTHER SET OF VALUES
_____	---	_____	---	_____
_____	---	_____	---	_____
_____	---	_____	---	_____
_____	---	_____	---	_____
_____	---	_____	---	_____
_____	---	_____	---	_____

Alright, where are we? We have been dealing with environmental problems and values. The whole thing started when you were asked if you

knew what environmental problems were. How well do you think you could define or describe "environmental problem" now? This is very important. Write out your definition below. Be sure to keep in mind the things you have been working with thus far. (I-11)

Definition of ENVIRONMENTAL PROBLEM: _____

_____

_____

_____

_____

_____.

A Closer Look

Whenever a scientist studies objects or events in the environment he or she does so by using one or more of the very important mental skills (or science processes as they are sometimes called). Some of these skills are observation, comparison, measuring, predicting, hypothesizing, and experimentation.

Another skill the scientist uses is classification. When a scientist CLASSIFIES he/she usually does so by grouping objects or events into groups that contain closely related kinds. Scientists classify many things because this organization produces groups that makes them easier to study. Scientists have done this with the elements, chemical reactions, rocks, minerals, plants, and animals. Perhaps you can think of other things that have been classified.

One way that we can more clearly look at environmental problems is to classify them. We could classify environmental problems in many different, useful ways. We could group them according to whther they were problems connected with air, water, soil, sound, animal life and so on. And, perhaps this would be useful eventually. Also, we could group them according to how important they are to man. Are they critical? Of moderate importance? Of only limited importance? It is doubtful that we will be doing our classifying this way, We are going to begin, at least, classifying another way.

Let's begin by asking you to think carefully and, if you can, identify one environmental problem that could fit EACH of the following headings (state each in question form if you can): (I-12)

A problem found within your school: _____

_____?

A problem that is of importance to the community as a whole: _____

_____?

A problem that exists in the geographic region in which you live: _____

_____?

A problem of national or international importance: _____

_____?

Actually, what you have done (assuming that your problems are correctly identified) is to begin a classification scheme. It is based on how far the problem is from you. This doesn't mean that one grouping is more important than another. It merely gives us a useful way to group and look at environmental problems. We are going to ask you to become a bit more expert in this classification.

Your next task is to investigate a number of different sources and identify four problems under each of the above headings. You may use your own knowledge, interview experts, go to newspapers, science journals, reputable magazines, and any other good sources you can defend to your instructor. In fact, your instructor may suggest some specific resources for you to go to. Also, don't overlook your own powers of observation in the school and community. As you identify these problems record them below: (I-13)

Problems Within the School:

1. _____

2. _____

3. _____

4. _____

Problems Within the Community:

1. _____

2. _____

3. _____

4. _____

Problems Within the Region:

1. _____

2. _____

3. _____

4. _____

National or International Problems:

1. _____

2. _____

3. _____

4. _____

Your listing of environmental problems should contain specific problems - ones that you can describe or communicate accurately. Check your lists to make sure you have clearly communicated specific problems.

You may have found, while preparing your lists, that some problems could fit under more than one heading. For example, if your community has a particular problem with illegal garbage dumps you may also find this to be a regional problem. Where do you list this? It seems fair for you to list it under both headings if you can defend doing this.

In science, you must never make a statement that cannot be defended. A scientist simply cannot draw conclusions based on no information. There are some areas of interest to human beings where guesswork is alright but this is not one of them!

With this thought in mind, we are going to ask you to choose ONE problem from each of the four lists above and DEFEND it. You are to defend it in terms of its being a specific environmental problem within that heading, i.e., school, community, region, and national or international. Your communication skills

should work well for you in this task. If you have problems getting started confer with your instructor. (I-14)

School Environmental Problem: _____

_____

Your Defense: _____

_____

_____

Community Environmental Problem: _____

_____

Your Defense: _____

_____

_____

Regional Environmental Problem: _____

_____

Your Defense: _____

_____

_____

National or International Environmental Problem: _____

_____

Your Defense: _____

Congratulations! You can now identify and defend a selection of environmental problems classified under these four headings. If this is the case, you have come a long way toward being an expert in the identification and classification of environmental problems.

At this time, we are going to ask you to do one more task in connection with the twenty problems you classified. Let us assume that your instructor was going to ask you to become an expert on each of these problems. This would mean a tremendous amount of research and study for you. You will probably want to look into some of these in detail but you don't have to worry about becoming a real expert with all of them. If you DID have to become an expert on each, how would you go about it?

There are two or three ways of becoming an expert. You can go out and get information (data) on a FIRST-HAND BASIS. This means that if you want to become an expert on the rat population in Chicago, Illinois you will have to go to Chicago and collect your information. This could involve figuring out a way to estimate the number of rats, trapping and checking rats for fleas and other parasites, going through medical records for cases of rat-transmitted diseases or rat bite, as well as many, many other things.

Another way to get information about an environmental problem is to use what are called SECONDARY SOURCES. Here you read research reports, books, newspapers, magazine articles, inspect maps, look at documentary photographs and bring all the information together in a final report of your own. Let's pretend you wanted to investigate the killing and conservation of the great whales throughout the world. It would be pretty hard for you to visit the South Pole as a part of your regular classroom activity. But, the information you want on the great whales is available. All you have to do is to dig it out and put all the facts together.

The third way to become an expert is to use a COMBINATION of the two techniques discussed above. With some problems this is entirely possible. If you want, for example, to investigate the land reclamation practices of

strip mine operators (and you live in a region where there is strip mining) you would want to check the laws, write and interview experts, as well as investigate practices first-hand in your own region.

Your task now is to go back through your classified problems and CODE each problem. Write your code in the margin to the left of each problem. Do this with a colored pencil if one is handy. Use the following code: (I-15)

F = First-hand Investigation

S = Secondary Sources Information

C = Combination of F and S.

When you are finished, your instructor may wish to check your coding. Perhaps he/she will want the class to discuss the logic used in the particular codes on this assignment. In any event, check your work to make sure you have thought the task through carefully.

Actually, what you have done here is to CLASSIFY your problems in still another way. Can you explain why this is a different but still a logical classification system?

What Are the Problem Questions?

The writer of this module is a good example of a person with mixed feelings about deer. He really doesn't want to go out in the woods and kill a deer. The reasons really don't matter - this is just one point of view or a VALUE DECISION. The value, however, probably deals with how he would prefer to spend his time. The writer might prefer to write, or fish, or take pictures of deer. However, the writer has another set of values concerning deer. These tell him that, in many cases, it is important for other hunters to shoot deer - sometimes thousands of them - even some does (female deer).

These values concerning deer seem to be contrary to logic but they are not. There is great value in killing deer in certain geographic areas. It's just that this writer doesn't like to spend his time that way.

Now, lots of people don't have this writer's values. Many people don't like the idea of killing deer and they don't want anyone else shooting them either. Even more people don't like the idea of killing does. These people number in the tends of thousands - maybe even the millions - and this can

cause problems. Let's see if we can analyze a part of this situation.

First of all, let us list a few scientific data for you to consider before you read further. These data concerning deer are:

1. Deer, when uncrowded in a region, can often grow large and strong.

2. Deer, when crowded, can overgraze the land available to them and starve in the process.

3. Where conditions (food, space, etc.) are good, does will breed in large numbers in the fall.

4. Where conditions are poor, does will breed in smaller numbers.

5. Where natural predators (mountain lions, etc.) do not exist, deer populations can grow to enormous numbers in only a few years.

6. About 25% of a deer herd can be killed each fall without decreasing the next year's population. In other words, if we have 4,000 deer available and kill 1,000 in the fall there will be 4,000 available next year in the herd due to reproduction.

7. Many deer killed by hunters in the fall would normally die that same winter from natural causes.

8. Killing one in four deer in the fall will often result in a healthier deer herd in the spring.

9. Overgrazing by deer destroys the habitat for other species, for example, rabbits, grouse, wild turkeys.

10. Huge populations of starving deer can do tremendous damage to agricultural crops in some areas.

Wildlife biologists have the data. They know that there is only so much range available for deer. They know how many deer can be harvested - better, how many deer SHOULD be harvested in order to keep the herds healthy. But, many people don't have these facts or refuse to listen to the facts. There are dozens of reports on long-term fights between wildlife biologists and people who don't want deer killed. Even so, we will look at only one of these fights. The one we will look at is not as famous as some others but it is true.

We must turn back the years and return to Pennsylvania around 1910. At this time, Pennsylvania was introducing deer into regions from which they had almost been exterminated. We won't go into the reasons why the deer had become extinct here but forest fires plus the development of the state by man had a great deal to do with it.

In any event, after 1910, forest fire control was established. Because

of this, the food supply for the deer in the state was excellent. Deer feed on what wildlife experts call "browse". Browse largely consists of the tender new growth produced by trees each spring and summer. Young forests produce about 200 pounds of available deer food per acre each year. This amount of food (browse) gets cut back at a fantastic rate as the forest grows. A hardwood forest that is around 35 years old will produce only about 25 pounds of browse per acre. This is much different than the 200 pounds produced by a very young forest.

A Hardwood Forest With Good Deer Browse. (Photo courtesy of Harold R. Hungerford.)

The mixed hardwood forest seen here contains good deer browse. A variety of trees and shrubs at different sizes provides leaves and tender young twig buds for deer. This forest has a thick growth of smaller plants partly because of the death of some of the larger trees (note the remains of a large tree on the forest floor). This provides space, moisture, and sunlight for many shrubs and tree seedlings to grow. Eventually, much of this forest would grow so high that the deer could not reach the leaves and buds.

You might wonder why an older forest produces less available browse than a younger forest. There are several reasons for this. First of all, in a young forest there are many young seedlings producing food. Also, it is close to the ground where the deer can reach it. As the forest grows, many seedlings die due to competition for space. Remaining trees grow tall and the food produced is grown at a height where the deer cannot reach it.

Getting back to the Pennsylvania story . . . around 1930 it is estimated that the state's forests could have a HEALTHY deer herd of about 250,000 animals. Instead, a rich food supply had allowed the animals to reproduce to over 750,000 individuals. You must also remember that deer had few natural enemies in Pennsylvania forests at this time. Even a ten year old who knows something about ecology could tell you that trouble was just around the corner.

The wildlife people of Pennsylvania knew that the situation was serious. Winter food supplies for the deer were just not extensive enough to support this many animals. As deer became hungry they began invading agricultural land. Thousands of deer were shot by farmers trying to protect their crops. The Pennsylvania Game Commission spent nearly $100,000 to build over 200 miles of deer-proof fence over a 14 year period. This didn't do much to solve the problem. Further, the deer were overgrazing their natural woodland areas which also seriously hurt other wildlife species such as rabbits and wild

Deer in Poor Condition. (Photo by Linda Hungerford.) What is the eventual fate of these deer if a food shortage continues?

turkey. Many deer died of malnutrition. Poachers took a few illegal deer but this didn't make much of a dent in the population either. Other weak and hungry deer were being run down and killed by wild dogs.

During all this time there was a law on the books that allowed the legal hunting of ONLY male deer (bucks) with antlers. Also, there was tremendous pressure to keep it this way. Even so, over a 25 year period, the law was modified 14 times to permit the taking of antlerless deer. Many people turned out to legally shoot deer for meat and, over the 25 year period, nearly 1,000,000 animals were killed.

At the end of this heavy kill period, Pennsylvania had a formula for hunting which worked out like this: For two years, hunting would be permitted only for mature bucks. During the third year, antlerless deer could be killed. During these third years upwards of 100,000 deer were often taken legally. But, the public screamed about the killing of so many deer. There was widespread bad publicity about the killing of antlerless deer. A buck-only law was put back into law due to public sentiment.

In an effort to increase food production for the deer, the Pennsylvania Game Commission permitted the heavy timbering of some forested areas. This could help promote the growth of young trees. In some areas they even took bulldozers and leveled large areas to promote the growth of seedlings. But, all of this did little good because the deer population was so huge that the animals cleaned out the new growth before it could even get started well.

The Game Commission had the facts and tried to present them to the people. They knew that a HEALTHY deer herd depended on keeping the numbers of deer under control. The best way to control the population was to allow licensed hunters to remove excess animals of BOTH SEXES.

This was the way things stood at the middle of the century. The Game Commission knew what had to be done. The public fought it every step of the way.

This is the end of our story. Just what were the environmental problems connected with this page from history? Do you think YOU could identify the problems connected with this situation? What follows is a list of questions. These questions might or might not be logical environmental problem questions concerning the Pennsylvania deer history. Consider each question carefully in terms of the history presented to you. You will find a blank in front of each

question. If the question is a logical one for this historical environmental situation, place an "X" in front of the question. If it is not a logical question do nothing! (I-16)

_____ 1. How can public opinion about deer hunting be changed so that opinion is consistent with the facts?

_____ 2. Should an animal be reintroduced into its former, natural range when its natural enemies no longer live there?

_____ 3. Should both male and female deer be harvested in an area where there are no natural predators and a limited food supply?

_____ 4. How can the amount of available deer browse be increased in a limited area?

_____ 5. Should big game poachers be arrested and fined even when they might be doing a game population a favor?

_____ 6. Should public sentiment be allowed to overrule ecologically sound game management principles?

+ + + + + + + + + + +

Still another environmental problem revolves around the alligator. The following information is presented to you so that you can analyze it for an important assignment.[1] While studying this information dealing with the alligator, you are asked to determine - for yourself - the important problem questions connected with it. You will be asked to state - and possibly defend - your problem questions at the end of this module.

> In late July, the State of Louisiana - which a year ago had tried to legalize the hunting of white ibis - defied public and official opinion across the country by declaring an open season on alligators. And while the 13-day hunt on 750,000 acres of Cameron Parish was not to begin until September 5th, within a week the alligator poachers were back in business in the coastal marshes, once again given alegal outlet for their bloody wares.
>
> Although the alligator is listed by the Secretary of the Interior as an endangered species, officials of the Louisiana Wildlife and Fisheries Commission dispute this classification. Estimating a population of 250,000 alligators in their own state, they have asked Secretary Rogers Morton to remove the species from the list.
>
> Federal law, it must be noted, does not prevent a state from allowing hunting of nonmigratory wildlife even if the species is

1. Much of the information here is taken directly or adapted for students from "The Audubon View", Audubon, Vol. 74, No. 5 (September 1972), p 124.

classified as endangered. But removal of the alligator from the list would make it easier for the Louisiana officials to sell their open season - which calls for the taking of 4,000 alligators of four-foot length or larger - to its own citizens.

Other Southeastern states and the Bureau of Sport Fisheries and Wildlife have criticized the Louisiana move as premature. The occupied range of the alligator remains vastly reduced throughout the Southeast, and there simply has not been enough time for replenishment of populations within the occupied habitats since protection became reasonably effective.

But the worst effect of the Louisiana alligator season will be the reopening of channels through which poachers across the South can market their stolen hides, including thousands believed to be held in storage since passage of the Endangered Species Act.

Your job, at this point, is to determine the environmental problem questions that are important for the information presented above. Since you may already know a good deal about alligators you must be extremely careful to ask only those questions which are logical and pertinent for the information presented here. Let's see how well you can do. One example is given for you to refer to. (I-17)

EXAMPLE: If one or more states are determined to permit the killing of alligators, how can the other southern states keep poachers from shipping and selling illegal hides through out-of-state channels?

1. _____

_____?

2. _____

_____?

3. _____

_____?

4. _____

_____?

5. _____

_____?

6. _____

_____?

Where Do I Look?

Finding information is the key to good research. Where do you get this information? You will probably have to do a good deal of library research. Also, you may find a need for writing for information or interviewing an expert (or several experts).

What follows are lists of secondary sources of information. In no way are they complete listings. Your chances of finding good, sound information using other sources are excellent. Most libraries, for example, will have a card catalog. Use it! Large libraries have a publication called The Readers' Guide. Here you can find listed all major articles written on just about any topic on which you want to do research. The lists that follow are only intended to help you get started. Use them in that manner.

Periodicals and Newsletters Having Research Value:

Title	Publishing Organization
American Forests	The American Forestry Association
Audubon	National Audubon Society
C. F. Newsletter	Conservation Foundation
Environmental Action	Environmental Action, Inc.
International Wildlife	National Wildlife Federation
National Parks	National Parks Association
National Wildlife	National Wildlife Federation
National Geographic	National Geographic Society
Natural History	The American Museum of Natural History
Nature Conservancy News	The Nature Conservancy
Population Bulletin	Population Reference Bureau

Wilderness Report	The Wilderness Society
Newspapers	Various publishers

Organizations Involved in One or More Aspects of the Environment:

American Forestry Association
1319 18th Street, N. W.
Washington, D. C. 20006

American Museum of Natural History
Central Park West at 79th Street
New York, N. Y. 10024

American Petroleum Institute
1271 Avenue of the Americas
New York, N. Y. 10020

Animal Welfare Institute
P. O. Box 3492 - Grand Central Station
New York, N. Y. 10017

Bureau of Land Management
U. S. Dept. of the Interior
Washington, D. C. 20240

Center for Environmental Education, Inc.
Suite 307
2100 M St., N. W.
Washington, D. C. 20037

Center for the Study of Responsive Law
1908 Q Street, N. W.
Washington, D. C. 20009

Common Cause
2100 M Street, N. W.
Washington, D. C. 20037

Conservation Foundation
1250 Connecticut Ave., N. W.
Washington, D. C. 20036

Consumer Alliance, Inc.
P. O. Box 1242
Los Altos, California 94022

Council on Environmental Quality
722 Jackson Place, N. W.
Washington, D. C. 10006

Division of Air Pollution
Public Health Service
U. S. Dept. of Health, Education and Welfare
Washington, D. C. 20201

Energy Research and Development Administration
12th St. & Penn. Ave., N. W.
Washington, D. C. 20545

Environmental Action, Inc.
Room 731
1346 Connecticut Avenue, N. W.
Washington, D. C. 20036

Environmental Defense Fund
1901 N Street, N. W.
Washington, D. C. 20036

Environmental Science Information Center
NOAA
Dept. of Commerce
Washington, D. C. 20235

Federal Water Pollution Control Administration
Office of Public Information
Washington, D. C. 20242

Forest Service
U. S. Dept. of Agriculture
Washington, D. C. 20250

Friends of the Earth
529 Commercial St.
San Francisco, California 94111

MODULE II

STUDYING ENVIRONMENTAL PROBLEMS USING SECONDARY SOURCES

Introduction

Some of you will want to study environmental problems which exist in school, in the community, or in the area where you live. In this case, you can often go right to the problem and observe it with your own eyes. But, some of you will want to investigate problems that cannot be investigated first-hand. For example, this would probably be the case if you were interested in world population problems, conserving the great whales, health hazards produced by African dams, or supersonic jet transportation problems. With these kinds of problems, you would need to go to second hand or secondary sources for information. Using secondary sources means doing library research, comparing written reports, writing for information, and asking experts for information.

This module will help give you the skills you need for collecting information using secondary sources. It will not provide all of the answers though. But, it will help a great deal!

Whenever you do careful research you must be as thorough as you can. Also, you must think critically at each step. Only by being thorough and thinking things through carefully will your conclusions be good ones.

The objectives for Module No. II will be found on the next page.

Objectives for Module II

As a result of working with Module II, you will be expected to be able to . . .

II-1. . . . compare two information sources about coal reserves and identify the important data (information, values, value positions) in each source and communicate how these data differ.

II-2. . . . identify governmental or private agencies to which you can write for specific information about an environmental problem.

II-3. . . . write a sample letter to an agency asking for information about a particular environmental problem. The letter is to be correct in terms of its general structure, the agency chosen to be contacted, and the kinds of information requested.

II-4. . . . read two environmental news articles and state at least two differing value positions as expressed in each article.

II-5. . . . locate and read one environmentally-related article approved by your instructor and write a brief summary which accurately communicates the main point(s) presented.

II-6. . . . choose an environmental problem, locate three good references concerning this problem, and correctly list these in written form.

II-7. . . . correctly identify the written information (and symbols) used on a card from the card catalog.

II-8. . . . correctly identify the written information (and symbols) used in a reference from the Readers' Guide.

II-9. . . . analyze a research report dealing with polar bear management and . . .

A. cite one source of information to which the author might have written for more information.

B. explain why the author was unable to answer one of the questions asked in the report.

C. determine if the author's values toward polar bear management are reflected in the report and, if they are stated or inferred, identify where this information is located.

D. state specifically why you consider (or do not consider) the research report to be a good, thorough job of covering the subject.

Garden Clubs of America
Conservation Committee
598 Madison Avenue
New York, N. Y. 10022

Institute of Scrap Iron
& Steel, Inc.
1627 K Street, N. W.
Washington, D. C. 20006

Izaak Walton League
1800 North Kent Street
Suite 806
Arlington, Virginia 22209

League of Conservation Voters
917 Fifteenth St., N. W.
Washington, D. C. 20005

League of Women Voters
1730 M Street, N. W.
Washington, D. C. 20036

Manufacturing Chemists Assn.
1825 Connecticut Ave., N. W.
Washington, D. C. 20009

Midwest Coal Producers Institute
Wildwood Lane
Springfield, Ill. 62700

National Air Pollution Control Admin.
Federal Building
26 Federal Plaza
New York, N. Y. 10007

National Audubon Society
950 Third Avenue
New York, N. Y. 10022

National Commission on Water Quality
1111 Eighteenth St., N. W.
Washington, D. C. 20036

National Geographic Society
17th and M Streets, N. W.
Washington, D. C. 20036

National Parks and Conservation
Association
1701 18th St., N. W.
Washington, D. C. 20009

National Wildlife Federation
1412 Sixteenth St., N. W.
Washington, D. C. 20036

Natural Resources Defense Council,
Inc.
917 15th Street, N. W.
Washington, D. C. 20005

The Nature Conservancy
Suite 800
1800 N. Kent Street
Arlington, Va., 22209

Planned Parenthood - World
Population
810 Seventh Avenue
New York, N. Y. 10019

Population Crisis Committee
1730 K St., N. W.
Washington, D. C. 20006

Population Reference Bureau
1755 Massachusetts Ave., N. W.
Washington, D. C. 20036

Resources for the Future, Inc.
1755 Massachusetts Ave., N. W.
Washington, D. C. 20036

Scientist's Institute for Public
Information
438 N. Skinker Blvd.
St. Louis, Mo. 63130

Sierra Club
1050 Mills Tower
220 Bush Street
San Francisco, Calif. 94104

Soil Conservation Society of
America
7515 N. W. Ankeny Road
Ankeny, Iowa 50021

Soil Conservation Service
U. S. Dept. of Agriculture
Washington, D. C. 20401

Water Pollution Control Federation
3900 Wisconsin Avenue, N. W.
Washington, D. C. 20016

The Wilderness Society
1901 Pennsylvania Ave., N. W.
Washington, D. C. 20006

Tuberculosis and Respiratory
Disease Assn.
National Headquarters
1740 Broadway
New York, N. Y. 10019

Zero Population Growth
Suite 606
917 15th St., N. W.
Washington, D. C. 20005

Regional Offices of the U. S. Environmental Protection Agency

Region I
Environmental Protection Agency
Room 2303
John F. Kennedy Federal Build.
Boston, Mass. 02203

Region II
Environmental Protection Agency
Room 908
26 Federal Plaza
New York, N. Y. 10007

Region III
Environmental Protection Agency
6th & Walnut Street
Curtis Building
Philadelphia, Pa. 19106

Region IV
Environmental Protection Agency
1421 Peachtree Street, N. E.
Atlanta, Ga. 30309

Region V
Environmental Protection Agency
230 S. Dearborn
Chicago, Ill. 60604

Region VI
Environmental Protection Agency
Suite 1100
1600 Patterson Street
Dallas, Texas 75201

Region VII
Environmental Protection Agency
1735 Baltimore Avenue
Kansas City, Mo. 64108

Region VIII
Environmental Protection Agency
Suite 900
1860 Lincoln Street
Denver, Colo. 80203

Region IX
Environmental Protection Agency
100 California Street
San Francisco, California 94111

Region X
Environmental Protection Agency
1200 6th Avenue
Seattle, Washington 98101

Examples of Local Resource People:

State Legislators

U. S. Senator or Representative

Work Chief - County Soil Conservation Work Unit, USDA

Insect and Rodent Control Specialist

Chemistry Teacher

Earth Science Teacher

School Nurse

School Principal

City Mayor and City Councilmen	City Planning Commissioner
County Board of Supervisors	County Clerk
Museum Curator	Mortician
City Zoning Commission	County Superintendent of Highways
Code Enforcement Officer (City)	The Utility Companies
Water Plant Superintendent	Corporate or Industrial Personnel
Waste Water Engineer	Newspaper Editor or Reporters
Real Estate Developer	Wildlife Biologist
County Conservation Officer	Ecologist
Alcohol and Drug Abuse Center	Petroleum Geologist
Biology Teacher	Landscape Architect

Watch Out!!!

Yes, watch out! If you are not careful you can get into lots of trouble when using secondary sources. Why? Because, if you are not careful and thorough, you will wind up with only one side of the story. This is very dangerous when it comes to making decisions.

You will recall learning that environmental problems reflect differing human values. In fact, if there weren't different sets of values, there would not be any problems. If some people did not value quiet, there wouldn't be anyone yelling about noise pollution around our major airports. If certain people didn't throw gum wrappers, match covers, and beer cans along the roads and in the streets (or parks), we would have little concern for littering. If all utility companies used effective emission control devices on their smoke stacks, few people would yell about air pollution caused by electric utilities. If all towns and cities had good sewage treatment plants, there would be little need for ecologists (and others)

to be concerned about the pollution of streams and rivers.

All of the problems above have two sides--sometimes several sides--to them. These "sides" are different groups of human beings operating on different values. You might find it interesting to try and identify the different values operating in each of the above problems.

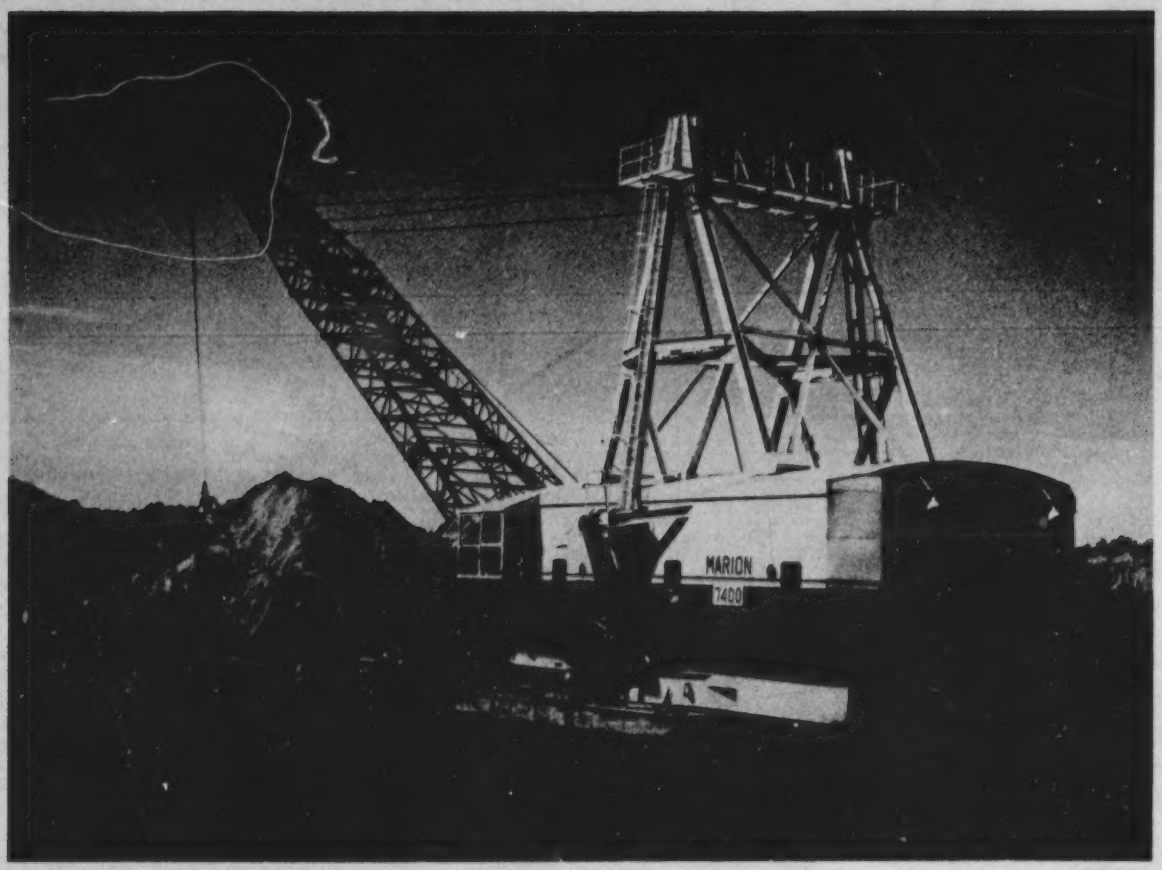
Let's take a look at a couple of secondary sources and see why it's possible to come up with information that just might not be totally accurate--or, at least show only one side of the story.

II - 1[1] A few years ago, General Electric published an advertisement dealing with man's limited coal supply and the need for developing nuclear generators for supplying electricity. Here is the main text of that advertisement:

> Experts say all the economically recoverable coal in the U. S. may disappear in 80 to 150 years. The world's supply in 300 years. And gas and oil before then.
>
> The world must find other fuels. Especially new fuels to generate electricity.
>
> One answer is nuclear power. General Electric has 68 nuclear plants in the works to help meet electric needs for years to come.
>
> For beyond that, GE is working with the government and utilities on a new nuclear power plant. A fast-breeder reactor.
>
> The fast-breeder has already been tested. Not only will it make electricity. It will make fuel . . . more than it uses. So it will postpone the fuel shortage . . . perhaps for thousands of years.
>
> GE is also working on ways to transmit more electricity over present wire. And new underground distribution systems.
>
> There's no easy way to meet future energy needs. But GE is working to make it easier.

---

1. All of the information for II-1 taken from the May 27, 1972 issue of Environmental Action.



It is clear that General Electric is attempting to convince the public of something. What is it? Please write your answer below:

_____

_____

_____

_____

_____

Yes, it would appear that GE is trying to convince the public that nuclear power plants are urgently needed. Now, what is the argument that General Electric is using? Please write this below:

_____

_____

_____

_____

_____

The basic argument lies in the limited amount of recoverable coal available for the production of electrical energy. According to GE, the recoverable coal supply will be gone in 150 years or less.

Now, let's turn to another secondary source on the topic of coal. The following data were prepared from Bureau of Mines statistics.

LIFE EXPECTANCY OF COAL RESERVES

The following is the estimated time table for depletion of presently recoverable bituminous coal and lignite reserves, assuming annual production figures of 1970:

	Quantity (billions of short tons)	Life Expectancy
Total deep mine reserves	356	590 years
Deep mine (low-sulphur) reserves	221*	367 years
Total strippable reserves	43	71 years
Strippable (low-sulphur) reserves	31	51 years

*The figure is about 1118 times the total amount of surface-mined coal burned by electric utilities in 1970.

In what ways do these figures differ from those presented by General Electric? Please write your answer below:

_____

_____

_____

_____

It would appear that it might be dangerous to rely on only one source of data (information) regarding a specific problem. Note that we are not attempting to tell you which set of figures is right. Certainly, one is wrong. Could they both be wrong? How might you go about an investigation to produce the answer to this question? This is a fairly tough task, but absolutely essential if you are to come up with reliable information concerning an issue.

Letters for More Information

There are times when it is necessary to sit down and write a letter for information. Although letter-writing is basically something you learn in your English class, there are a couple of points that we want you to always keep in mind when writing an information-seeking letter.

First, go to the source that seems to be the best for your particular purpose. Some students make poor choices as to where to write for information. However, at this time we would guess that you could make good

choices. Let's see how well you can do.

Earlier in this module you found a list of agencies that could provide information on certain kinds of environmental problems. Below you will find two specific problem questions. What agency would you choose to write to for information relating to each question?

II-2 Problem Question: How many acres of timber are harvested each year in national forests? To which agencies would you write?

Choice 1 _____

Choice 2 _____

Problem Question: What human values are at work which keep the world's population growth from reaching zero? To which agencies would you write?

Choice 1 _____

Choice 2 _____

There is a second point you need to keep in mind when writing for information. It is simply this: BE VERY SPECIFIC IN YOUR REQUEST! People who work in the agencies to which you will be writing have one major complaint. They get letters from students requesting all the information they have--on everything. Such requests make their jobs impossible. Some agencies have stopped answering such letters. Requests like this show only that the student has not thought much about what he is doing. Can you blame officials for not answering these kinds of letters?

Earlier in this module, you were presented with two different sources that gave two very different pictures concerning coal reserves. If you were

studying the problem concerning the use of fossil fuels you might want more information. At least this is what one of the authors of this module thought. Therefore, more information was sought.

What follows is the letter written for more information about coal reserves. Note the specific information requested. After this letter you will find the letter that was received in response to this request. You will observe that the writer of that letter went to a great deal of work to try to provide good information in answer to a very specific request.

The letter requesting information:

Science Education
College of Education
Southern Ill. University
Carbondale, Illinois 62901
18 Sept. 1972

Mr. Lew S. Weber
Midwest Coal Producers Inst.
Wildwood Lane
Springfield, Illinois 62700

Dear Lew:

I am trying to get an expert's opinion on a question that has been raised via conflicting references. You are probably in a position to know something about the topic since it deals with available coal reserves.

Some time ago General Electric sponsored an advertisement which stated that the reserves of economically recoverable coal in the United States would last no longer than 150 years. This statement was used as a defense for producing nuclear power stations.

Now, the Bureau of Mines has reported that, based on electric utility consumption in 1970, we have in excess of 200 billions of short tons of recoverable low-sulphur coal from deep mine reserves. Low-sulphur strippable reserves are put at about thirty short tons. This gives us about 250 years of reserves based on current consumption.

I have heard you say that demand will increase sharply over the years. However, there must be a set of figures that one can turn to with some

degree of confidence regarding the recoverable reserves of coal. Do you suppose you could pass some reliable estimates on to me?

You are probably naturally curious as to what I want with these figures. I am currently helping prepare a modular training program in environmental education for middle-school students. I simply need reliable figures to work from.

I sincerely hope that all goes well with you and your work. Please drop by and see me when you are in Carbondale; it would be a pleasure to talk with you.

Respectfully yours,

Harold R. Hungerford, PhD
Science Education

The reply letter from Mr. Weber (addresses not included):

Dear Harold:

. . . usually any estimate is subject to change due to changes in figures and conditions upon which the estimate was made.

I think that we have all in our reading run across various numbers that have been given to our coal reserves, but I believe if I were you I would accept the current figures set forth in the Bureau of Mines' Mineral Yearbook covering coal--bituminous and lignite. This publication provides the most comprehensive breakdown of this estimate that is available. It breaks it down by state and by the various classes of coal, shows depletion and remaining reserves and also a column designated "Recoverable Reserves". One reason for the variation in these figures is that some present estimates on the basis of reserves on which there is some basis for existence and in addition present estimates on belief that additional coal measures exist upon which there is no present evidence.

The September 1972 issue of Coal Age on page 95 lists the estimated reserves for the United States as 3,210 billion tons. The 1970 Minerals Yearbook lists 1,556 billion tons of remaining reserves. In this case, I believe the 3,210 billion tons includes the Bureau of Mines estimate of 1,556 billion tons plus another like amount upon which there is no present evidence (as stated above.)

It is also of interest to note that the Bureau of Mines assumes only 50 percent recovery and this reduces the 1,556 billion to 778 billion tons. Often

this latter figure is further qualified with the explanation that it would not be possible to recover all of this coal with current mining technology and economic conditions . . . (and therefore some reduce this down to one-quarter which still provides for several hundred years at the current rate of consumption).

Sincerely,

L. S. Weber
Director of Conservation

As you can see, the letter from Mr. Weber was a big help in obtaining additional information about coal reserves. And, he also suggested still another source of information.

How well do you think you could do requesting information from an agency by letter? We are going to give you (and your instructor) a chance to find out.

Please think of a specific piece of information that you might obtain from one of the agencies listed on the first three pages of this module. Pretend you need this information. On a separate sheet of paper write that letter. Your letter will be judged in terms of its general structure, whether you have written an appropriate agency, and whether you have been specific in your request.

If you are worried about a proper form to use in writing your letter, why don't you take a look at the two letters you just read in this module, as examples (realizing that the headings were left off the second letter)? (II-3)

Seeking Information From Resource People

Often your local community contains individuals who are personally knowledgeable on certain environmental issues. These people are usually very willing to share their information. Resource people may also have

pamphlets, maps, and other literature on a specific topic. In your search of secondary sources, do not overload the possibility of contacting such persons.

If you should choose to seek information through a personal contact, remember to apply the same points that were emphasized in writing letters for information. Choose the best resource person for your particular purpose and be specific in your requests to that individual.

When you meet with the resource person, be courteous and polite. It would be an error to take too much time for an interview. Plan your questions carefully beforehand so that you can be efficient during the time you have. A final suggestion is to remember that each person you contact for information has his or her own value position. As you go over the information you received from a resource person, remember that it may show you only one position on the issue. Evaluate the information carefully!

I DUNNO HAROLD, THERE OUGHT TO BE ROOM FOR JUST ONE McDONALD'S!

Checking Those Values

II-4[1] - Please don't think that you will find only one set of values in each secondary source you read. Many articles, books, and news articles attempt to present differing views even though the author's position might be obvious.

At this point we are going to have you look at two short news articles. In these, opposing sets of values are either clearly stated or strongly inferred. As you read these, attempt to identify differing values in both. You will be asked to state what these differing positions are.

First Article: Brazilian Animals Decimated

> Brazil has launched a major campaign to save many of its wild animals from extinction at the hands of man. However, experts are skeptical about the attempt's chances of success unless women around the world voluntarily refuse to purchase clothing made from animal skins and furs.
>
> Last year, hunters killed more than 17,000 spotted cats and 50,000 wild boars in one province alone. Brazil's near-extinct list is long, and includes the jaguar, the otter, the wild dog, and a gentle anteater resembling a small, shortlegged pony. At least 23 species of birds are also likely to disappear.
>
> A Brazilian zoologist, Jose Candido de Melo Carvalho, predicted, 'Slaughter on this scale can go on only a few more years before everything is wiped out.' The country, larger than the United States, is unable to guard all of its long border against smugglers and fur and bird traders.

Second Article: More on Mickey Mouse

> The battle rages on between Walt Disney Productions and the Sierra Club.
>
> Disney wants to build a lavish year-round mountain resort in the Mineral King Valley of California. The Sierra Club wants Mineral King to remain as it is--an undisturbed National Game Refuge inside a National Forest.
>
> Although the Sierra Club lost it lawsuit against the National Park Service on this matter, it now appears that Disney is the one which is backing down on its original grandiose schemes. At a press conference in early May, the Company announced that it was scaling down the venture from a cost of $35 to a mere $20 million. It further stated, it would cancel plans for a highway by substituting a 15-mile-long cog railway, and would cut projected visitor capacity from 14,000 to 8000.

In response, the Sierra Club promised to pursue further legal action to halt the project entirely. Michael McCloskey, executive director of the Club, summed up its position with, '$20 million still sounds like a huge project. It's an inappropriate use for the area.'

McCloskey continued, 'I'm not taking issue with the sincerity or engineering skills of the Disney organization. We still have basic doubts about the compatibility of a project of such magnitude with the fragile ecology of a high mountain game refuge. Mineral King should be part of Sequoia National Park, which it borders.'

Meanwhile, Douglas Leisz, regional director of the Forest Service, said the agency is 'delighted to support' Disney's new plan of a 'nonpolluting, environmentally compatible access system.'

Just what are the differing value positions in these two articles? Remember, if one position is strongly inferred and not stated outright, it is perfectly alright to state it.

Value positions in Brazilian animals article:

1. _____

_____

_____

2. _____

_____

_____

---

1. Both articles presented in this segment of Module II are taken from Environmental Action. The first comes from the June 26, 1971 issue. The second is taken from the May 27, 1972 issue.

Value positions in Mickey Mouse article:

1. _____

_____

_____

2. _____

_____

_____

Actually, there is a third value position in the Mickey Mouse article. Can you identify it? What is this value position?

Summarizing What You Read

If you study a problem that forces you to go to secondary sources, you are going to have to keep some sort of record to keep the facts straight. And, you are going to have to be able to show where you get your information.

One way to keep records is to use note cards or a section of a notebook in which you record summaries of articles you read. Any summarization should hit hard at the main point(s) of the article in a logical and understandable manner. It should be complete enough to be useful when next you need it. However, it should also be to the point, without unnecessary wordage.

It would take too much space to reprint a full-length article here and

then summarize it for you. Even so, we are going to cite an article and write a summary of it so you can see a real summarization of an article dealing with an environmental problem.

Let us assume we are investigating air pollution on a world-wide basis. What follows is a summary of one of the articles read:

Article: Belli, Carlos G. "Deadly Dome Over Lima," International Wildlife. (March-April 1972) 38-40.

Summary: Mr. Belli reports that air pollution in Lima, Peru is frightening. This is due, in part, to the geographic position of the city which results in air being trapped over the city. Also, factories producing fish meal have been built and contribute heavily to air pollution. Similarly, automobiles have blossomed here (110,000 in 1963 and 250,000 by 1970).

Every year, Lima gets 18.2 tons of contaminating materials per square mile. This gives Lima enough air pollution to rank it No. 8 on the entire earth. Only Chicago, New York, and Los Angeles in the U.S.A. are worse. Some of the dangerous pollutants in Lima are carbon monoxide, sulphur dioxide and sulphuric acid.

Lima also suffers from waste water pollution, trash disposal problems, and a shortage of green vegetation. The only hope for Lima lies in the fact that people are now aware that they have a serious problem.

At this point in time we are going to ask you to read an article concerning one environmental problem and summarize it. Following this paragraph is a list of suggested articles which could be chosen for such a task. Your instructor can also give you permission to read another article. There are many available.

Article Reference List:

"A Vast Blanket of Hot Smog--And Maybe More to Come," U. S. News and World Report. (July 31, 1972) 62-63.

Barbour, John. "Crocodiles at Bay," International Wildlife. (September-October 1976) 5-11.

Barbour, John, "It May Be Farewell for the Atlantic Salmon," International Wildlife. (September-October 1971) 3-7.

Barbour, John. "Up From the Sea," International Wildlife. (January-February 1976) 4-13.

Beck, Alan M. "The Life and Times of Shag, a Feral Dog in Baltimore," Natural History. (October 1971) 58-65.

Canby, Thomas. "Can the World Feed Its People?" National Geographic. (July 1975) 2-31.

Carr, Archie. "Operation Mermaid," International Wildlife. (March-April 1976) 12-17.

"Europe's Supersonic Concorde: A Flying White Elephant?" U. S. News and World Report. (Sept. 25, 1972) 80-81.

Fialka, John. "Running Wild," National Wildlife. (February-March 1975) 36-40.

George, J. S. "What's Ahead for Our National Parks?" National Wildlife. (February-March 1972) 36-40.

Golden, Frederic. "Shifting Sands," International Wildlife. (January-February 1977) 20-27.

Gore, Rick. "Twilight Hope for Big Cypress," National Geographic. (August 1976) 251-273.

Graves, William. "The Imperiled Giants," National Geographic. (December 1976) 723-751.

Hirst, Eric. "In Praise of Bikers, Hikers, and Crowded Cars," Natural History. (August-September 1972) 15-16.

Josephy, A. M. "Dr. Strangelove Builds a Canal," Audubon. (March 1975) 77-112.

King, F. Wayne. "Adventures in the Skin Trade," Natural History. (May 1971) 8-16.

LaBastille, Ann. "A Delicate Balance," National Wildlife. (June-July 1976) 28-32.

Laycock, George. "The Falconer's Paradox," Audubon. (September 1971) 64-71.

McCarthy, Colman. "Will We Let Pollution Nibble Us To Death?" Reader's Digest. (August 1972) 75-76.

Morgan, Lael. "In Alaska, Another Wolf Kill Up Against the Wall," National Wildlife. (August-September 1977) 6-13.

Myers, Norman. "The Selling of the Zebra," International Wildlife. (January-February 1978) 26-31.

Myers, Norman. "Under the Gun," International Wildlife. (November-December 1976) 5-16.

Ott, George. "Is the Bald Eagle Doomed?" National Wildlife. (April-May 1970) 4-9.

Schiller, Ronald. "Get Those Junked Cars Off the Landscape!" Reader's Digest. (September 1972) 88-92.

Soucie, Gary. "Subdividing and Conquering the Desert," Audubon. (July 1973) 27-35.

Sterling, Claire. "Super Dams: The Perils of Progress," Reader's Digest. (July 1972) 95-98.

Whitaker, Zai and Romulus. "If They're Killers, What Good Are They?" International Wildlife. (May-June 1977) 12-16.

Young, Gordon. "Will Coal Be Tomorrow's Black Gold?" National Geographic. (August 1975) 235-259.

Zeleny, Lawrence. "Song of Hope for the Bluebird," National Geographic. (June 1977) 854-865.

Write Your Article Summary Here: (II-5)

The Article: _____

_____

_____

The Summary: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Is your article summary brief but complete? Does it get at the main point(s) in the article? Does the summary capture the value position (bias) of the writer (if such exists)? Does the summary contain valuable information that you could use later in a report on the topic?

Share your summary with your class. Can your classmates identify the main idea of the article from your summary? Perhaps two of you have summarized the same article. How do the summaries compare? Do both of the summaries contain the same main points? Of course, your instructor may want to evaluate your summary.

The Search for References

You have just finished summarizing one article. Perhaps you found the subject matter interesting--perhaps not. Of course, you might also have found the article to be of little value in terms of that particular environmental problem. As you already know, not all references are of equal worth. Not all references agree. Some reflect misinformation or only one value position. Once again, we point out how IMPORTANT IT IS TO OBTAIN MORE THAN ONE VIEWPOINT WHEN USING SECONDARY SOURCES.

Can you find more than one reference on a particular topic? How good are your research skills? The next task may prove to be difficult and frustrating for you. We are going to ask you to pick a topic that demands the use of secondary sources. When you have picked your topic, you are to search for three (3) separate articles or similar references on that topic. Unless your instructor tells you otherwise, you are to complete this search in a library.

Once the topic has been chosen, find information from at least two different sources. This simply means that we do not want you to pick a

topic and then get all of your information from one source, e.g., National Wildlife.

When you have found all three references please list them in the space provided further on in this module. The listing of articles in the previous section of this module should help you see how these articles should be listed. If you run into a problem writing out your references, check with your instructor.

Following this paragraph is a listing of sample problems from which you might choose. Some topics will be more difficult than others when searching for references. Also, you may have another topic in mind that you would prefer to research. If your instructor gives you an O.K. to work on another topic, it is perfectly alright.

Possible Topics for Library Research (II-6)

Problems of Garbage Disposal
Protecting the Great Whales
Soil Erosion
Preservation of Salt Water Estuaries
Radiation Hazards - War and Industry
Alligator Poaching
Auto Exhaust Emissions
Endangered Plant Species
Water Pollution
Strip Mining
Noise Pollution
Pollution of the Great Lakes
Alternative Energy Sources
Religious Attitudes Toward Birth Control
Mercury in the Environment
Hard Pesticides
City Planning
Problems of Urban Population Centers
Littering
Glass and/or Metal Recycling
Abandoned Cars
Conservation of the Bald Eagle
Oil Spills
Human Population Explosion
Air Pollution
Thermal Pollution
Land Use Management
Wilderness Preservation

Depletion of the Fossil Fuels

The SST - Foreign or Domestic

Rats in Man's Environment

Predator Control

State the Problem Chosen: _____

_____

References:

1. _____

_____

2. _____

_____

3. _____

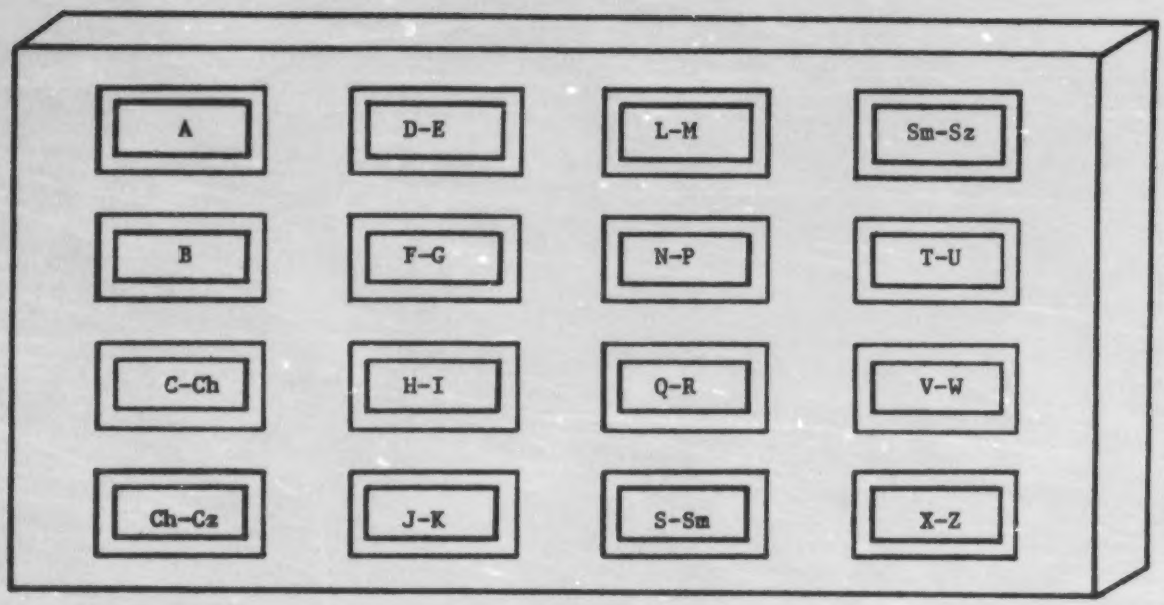
_____

_____

You may have noticed some frustration in finding good articles from references in the library. This could be due to your inability to successfully carry on such research in an expert manner. The library is an excellent place to gather information from secondary sources, but you MUST know how to use it before it becomes an effective tool. If you are not expert in this area, the next few pages will be of tremendous help. Please take them seriously!!!

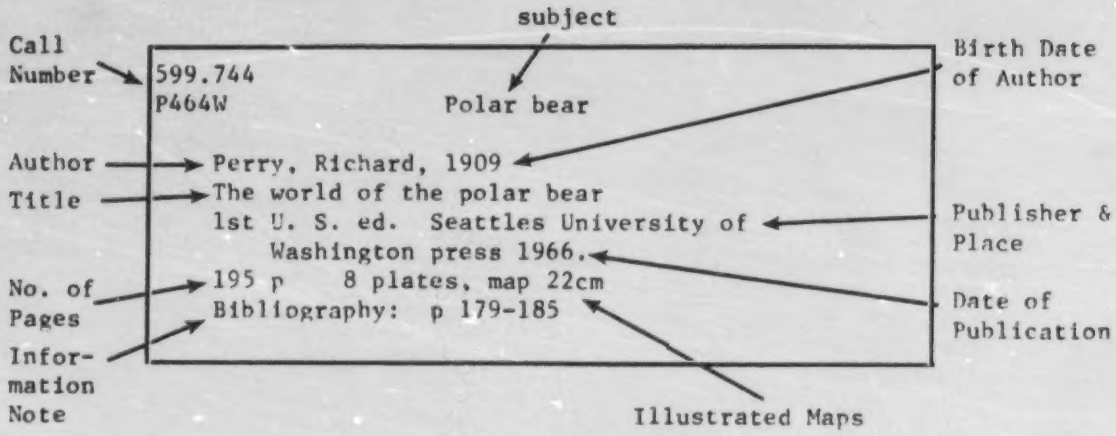
The Card Catalog

Most libraries contain one or more card catalogs. These are usually wooden or metal filing cabinets containing one or more cards on every book found in that library. The drawers, as well as the cards found within them, are arranged in alphabetical order. On each drawer is one or more letters that serve as guide letters. These letters tell you which cards can be found in that particular drawer.



Inside these drawers are catalog cards. There are basically three types of catalog cards. These are called "author cards", "title cards", and "subject cards". On each of these cards is found a considerable amount of information. Below are samples of each of these cards. Please note the information to be found on each.

Sample of Subject Card



Sample of Title Card

```
599.744
P464W          The world of the polar bear

               Perry, Richard, 1909-

   The world of the polar bear by
   Richard Perry
   1st U. S. ed. Seattles University of Washington
       Press 1966.
   195 p  8 plates, map 22 cm
   Bibliography:  p 179-185
```

Sample of Author Card

```
599.744
P464W          Perry, Richard, 1909-

   The world of polar bear by
   Richard Perry
   1st U. S. ed. Seattles University of Washington
       Press 1966.
   195 p  8 plates, map 22 cm
   Bibliography; p 179-185
```

As you can see, the three sample catalog cards pertain to the same book. There are, however, three different "headings" a person could have looked under to find this book on polar bears. If a person does not know the title of a book and knows what subject he is interested in or the name of an author noted for work in that area, he has at least two options open to him in terms of searching for an appropriate book. This strategy is known as "cross referencing". Of course, if you know the exact title of the book you are looking for, you are all set. But, how many times will you know exactly the book for which you are looking?

Some libraries have separate card catalogs for each type of card. Other libraries, however, often interfile the three cards in one or two catalogs.

Assume that you have found the card that is meaningful in your search for information. How do you find the book? Books are arranged on the library shelves according to the Dewey Decimal System - books are broken down in this arrangement according to ten (10) main classes. These are as follows:

000-099 - General works and reference materials (such as encyclopedias)

100-199 - Philosophy, psychology

200-299 - Religion

300-399 - Social Studies

400-499 - Languages

500-599 - Sciences, mathematics, geology, botany, zoology, etc.

600-699 - Useful (applied) arts and sciences such as medicine and engineering

700-799 - Fine arts such as art, music, recreation, etc.

800-899 - Literature such as novels, poetry, essays, drama, etc.

900-999 - History, geography and travel

The call number on the catalog card will help you locate your book. The first three numbers will tell you to which "class" your book belongs. The book on polar bears was numbered 599.744. This means that it belongs to the "500 class" or that one dealing with the sciences. You would simply locate the area of the library in which the "500" books are shelved and search for 599.744. Books are arranged within each class in numerical order. This means, for example, that a 586 book will be shelved in front of the 599.744 book for which you are looking.

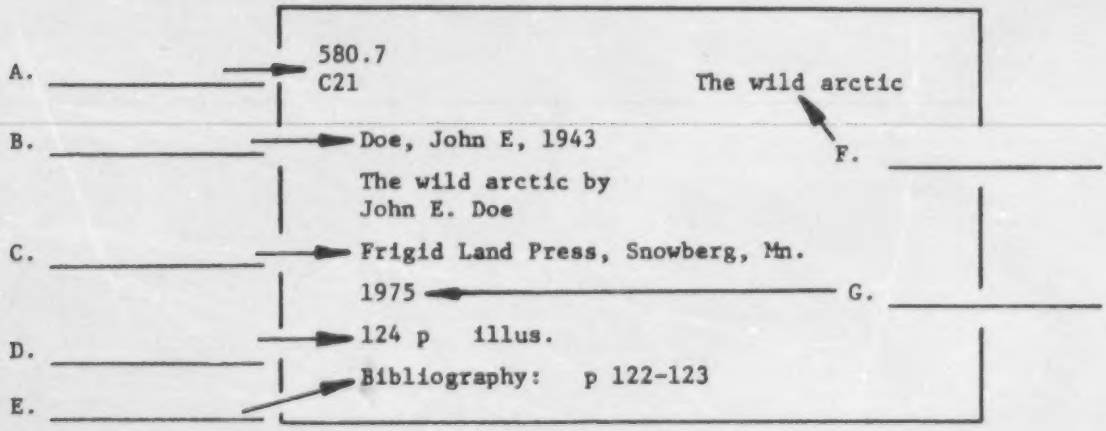
II-7. Looking Back at Catalog Cards - "Just for fun", let's see how much you can remember about the data found on cards in the card catalog. Respond to the two questions below and then fill in the blanks which surround the model card designed for this purpose:

a. What kind of card is the one seen below? _____

_____

b. In what area of the library would this card be found? _____

_____

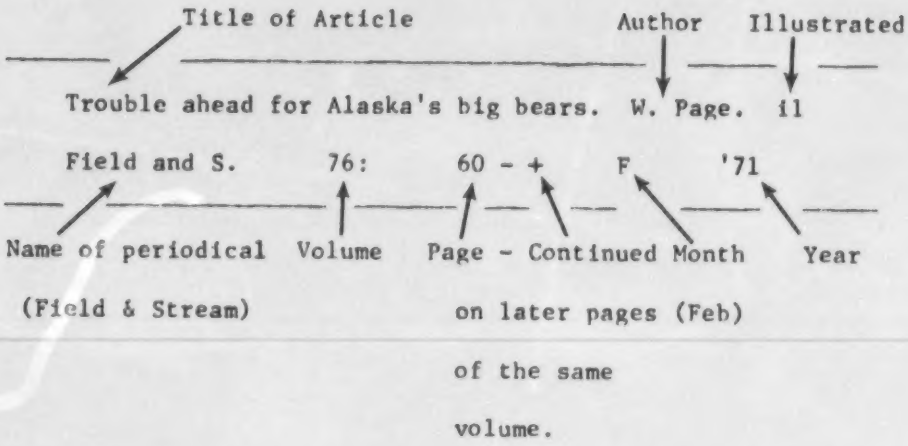


A Good Friend: The Readers' Guide

Many times you may not be able to locate books that pertain to a particular topic - or, you might not be able to locate enough information in books. What do you do then? If this becomes a problem, DO NOT DISCARD the topic for research! Chances are you can find a good deal of information by using another source - The Readers' Guide.

Using The Readers' Guide is not at all difficult once you get the hang of things. This publication is actually a series of books that contain listings of articles published in periodicals (periodicals are magazines published at different intervals - monthly, bi-monthly, quarterly, etc.). The articles found in The Readers' Guide are classified alphabetically according to subjects. The entry following deals with bears. Note the information you can get from this entry.

Subject: BEARS



At the beginning of each volume of The Readers' Guide there are explanations to help you interpret the information you will find in each listing. This explanation consists of the following items:

1. Abbreviations of the periodicals indexed.

2. Key to other abbreviations used.

3. Sample entry with explanation of each part of the listing (see previous page).

Of course, the final step would be to take the articles found listed in The Readers' Guide and go to the periodical section of the library and find the actual articles (assuming that the library in which you are working keeps those particular periodicals.) Periodicals are arranged on the library shelves alphabetically and then in numerical order according to volume number.

Cross Indexing - The Readers' Guide

Occasionally you may have a difficult time locating reference materials if you do not understand cross indexing. Cross indexing is a term that refers to locating reference materials on a particular topic by looking under the "headings" of related topics.

Let us assume that you need to locate information regarding solid waste disposal. You go to The Readers' Guide in the library and find that there is not a single article under the heading, "solid waste disposal". However, there is a note which suggests that you look under "refuse" and "refuse disposal". You then look under these headings and find, just to mention a few:

Clean new gas; methane from feedlot wastes.
H. L. Hohn. bibliog. il Environ 13: 4-9 D'71

Let's speak up on solid wastes, truthfully. W. A.
Xanten. il Am. City 86-100 Je'71

Recycling wastes. il Nat Wildlife 9: 37 O '71

What's happening in solid wastes. Am City 86: 96
Jl '71

There are many other articles also listed under this heading. You

might feel that this is great! It is, but don't stop there. You will often find, under the last article of a particular heading, further cross indexing aides. Using the example above, you would find the last article (to mention only a few):

See also:

Cleaning of cities and towns, etc.
Sewage disposal
Waste disposal in the ocean

If you were to look under each of these new headings, you would quite possibly find a number of articles pertaining to the topic you are investigating.

II-8. Looking Back at The Readers' Guide. Let's see what you remember in terms of the written material and symbols used in The Readers' Guide. Below, you find repeated one of the references listed above. Fill in the blanks with the appropriate information and ask your instructor to check your responses.

a.

Clean new gas; methane from feedlot wastes.

H. L. Hohn. bibliog. il Environ 13: 4-9 D '71

b. c. d. e. f. g. h. i.

a. _____ f. _____

b. _____ g. _____

c. _____ h. _____

d. _____ i. _____

e. _____

Researching for Keeps: An Example

How you go about the task of doing research using secondary sources is largely determined by the topic, the questions needing answers, and your knowledge and skill as a researcher. What follows is an example of a research report completed by a student on the topic of polar bears. The major question posed by this research deals with whether the polar bear is an endangered species. Other, minor questions have also been answered via this research, e.g., what is the life cycle of the polar bear?

The writers are presenting this report as a model but they also want you to think critically about the quality of the research report and the bibliography at the end. You will be asked to complete a few tasks relative to it when you have finished reading the report.

The Polar Bear: An Endangered Species?

Are polar bears an endangered species? Should we be concerned about the conservation of these animals? Is it already too late? Is anything being done today to protect the polar bear? Before we attempt to answer these questions intelligently, we should first look at the general characteristics of the polar bear and some of the known facts about this species.

Thalarctos maritimus is the scientific name for the polar bear. This name means "sea bear". The name is quite appropriate as the polar bear is an excellent swimmer. Its color usually varies from a light yellow to a creamy white. A full grown bear may be up to nine feet tall (when standing on its hind legs) and weigh up to 1600 pounds. However, the average weight is about 900 pounds.

The polar bear usually hunts over a large area unless there is a suitable amount of food available in a small area (e.g., a dead whale up on the

shore.) This mammal is perfectly willing to act as a scavenger at these times but the polar bear is usually thought of as a meat eating predator, at least during the winter months. Its carnivorous diet consists mostly of seals, baby walruses, stranded whales, fish, and occasionally lemmings and mice.

Adult male bears do not hibernate but seek rest and refuge in dens only during extreme winter weather. Most male polar bears are on the prowl all winter long. They may travel from 20 to 50 miles per day in search of food. Their appetite is quite hearty and they can devour as much as 150 pounds of meat and blubber in one sitting.

Near July, when many of the icebergs have melted, the polar bear changes its carnivorous diet to one that is mostly vegetarian. It now seeks grasses, sedges, sorrel, seaweed, and berries. During these warmer months, the polar bear also hunts lemmings, eider ducks and snow geese. Although they may not always capture their prey, the bear will often feed on the eggs of ducks and geese.

The life expectancy of the polar bear varies greatly. At Regent's Park Zoo in London, a polar bear lived for some 40 years. However, the life span of such a bear in the Artic is usually much shorter.

The female polar bear becomes sexually mature at the age of four. She almost always mates in April, but does so only once every three or four years. When winter approaches, the pregnant polar bear digs a den in which to have her cubs. The gestation period is nine months. Most cubs are born in early December. If this is the first offspring of the sow (female bear), it will often be a single cub. After the first birth, the sow almost always has twins and occasionally triplets.

Cubs are usually blind, lack fur, and are deaf at the time of birth. Newborn babies weigh about two pounds and are approximately ten inches long. Sometime in March or April, the sow digs the way out of their den. The cubs are partially weaned by mid-July. At this time, they feed on seals killed by their mother. Until they learn to kill bigger game, their diet is supplemented by only crabs, shellfish, and seaweed. The cubs must be nurtured 18 months after birth in order to survive. They may weigh close to 400 pounds when their mother leaves them to fend for themselves.

ENDANGERED HECK! I'LL BE GLAD WHEN THEY'RE EXTINCT!

Polar bears remain a great mystery to man. This is due to the fact that there is little research data regarding the natural history of this bear. Research is hampered by adverse weather conditions and the lack of tracking methods for following these wandering animals.

The first actual scientific fieldwork was accomplished by C. R. Harrington of the Canadian Wildlife Service in 1961. The Manitoba and Ontario governments followed with aerial surveys respectively in 1962 and 1963. Worldwide attention then began focusing on the plight of the polar bear. In 1965, the First International Scientific Meeting on the Polar Bear was held in Fairbanks, Alaska. This meeting was attended by the five polar countries concerned about the polar bear (i.e., Canada, Denmark, Norway, U.S.S.R., and the U.S.A.). At this meeting, these nations discussed protection of cubs and females, cooperation on research, and the need for an expanded study program. More extensive research has since begun and has improved considerably by immobolizing the bears with a harmless drug shot from a gun and tagging them.

Although far from complete, research has indicated some interesting points. People had generally accepted the idea that polar bears wander over the entire polar area. However, preliminary evidence from "tagged" bears suggests that the polar bear is not circumpolar. There may also be separate regional races of bears. If this is found to be correct, each interpolar country could manage its own polar population. Another interesting and alarming aspect about the polar bear is that even though they are at the top of the food chain--they have been found with traces of DDT and other pesticides in their bodies--thousands of miles from where these chemicals had originally been used.

Many important questions remain unanswered. Scientists still do not fully understand how polar bears can survive in temperatures as low as -65 degrees F. Nor do they thoroughly understand the movements of the bears throughtout the year, the longevity of bears in the wild, the distinctness of bear populations, or even how many polar bears there are remaining in the world. The origin of the bear population off the northeast Alaska coast is still a mystery because no large maternity-denning areas have yet been located in Alaska.

The polar bear appears to have many enemies with which to contend. They can suffer from foot infections, broken bones, arthritis, and even tooth decay in older individuals. A hungry bear will sometimes kill another bear for food. Wolves and large walruses kill a few polar bears each year. Slowly, over a long period of time, the artic temperature has become warmer and this may be shrinking the polar bear's habitat.

At the top of the polar bear's enemy list is man. Due to increases in population and the demand for more power and natural resources, man is being forced to explore and develop that part of the world which was once the kingdom of the polar bear. Seal hunters make serious inroads on the polar bear's food supply. And, as seal supplies diminished, many hunters turned to killing the polar bear. High prices on polar bear skins, trophy hunters, and tourist-trade-hungry countries worsened the polar bear's population plight. A few data indicate the tremendous increase in polar bear mortality due to hunting:

Year	Bears Taken
1940	148
1950	277
1960	509
1968	700 +
1971	1300 +

Wildlife biologists and conservationists fear that the polar bear is in real danger of becoming extinct. It is estimated that there are only between 5000 and 20,000 polar bears alive in the world today. If the number of kills continues to increase at the astounding rate it has in the past few years, the polar bear could become extinct in a relatively short period of time. It must be remembered that the reproductive capacity of the bear is extremely limited. There is no way that polar bears can increase their reproduction at the same rate that hunting pressure is increased.

The five polar countries concerned with this problem have made varying degrees of effort producing laws pertaining to the hunting of the polar bear. In 1956, the U.S.S.R. banned all hunting of the polar bear. Recently, set guns and trophy hunting were banned in Canada. The International Union for Conservation of Nature and Natural Resources, located in Switzerland, had placed the polar bear in its "Red Data Book" (a widely recognized official list of the world's rare and endangered species). The United States' two most influential hunting groups, the Boone and Crockett Club and the National Rifle Association, no longer offer awards of recognition for the shooting of a polar bear. No hunting of polar bears by whites is allowed in Manitoba. However, the Eskimos now have snowmobiles and are able to hunt these bears more efficiently. Possibly the reason for these different laws is the overall uncertainty of the polar bear population and its natural history. It now appears that the polar bears of Labrador may be almost extinct. Only on the west coast of Hudson Bay do they seem to be on the increase.

The conservation and/or management of a natural resource refers to the wise use of that resource. The safe extent to which polar bears can be hunted appears to be a very real problem.

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"Window on a Polar Bear World." Science Digest, 70 (November 1971), 18-19.

II-9. Analyzing the Research Report

1. The writer of the research reports that a young polar bear weighs up to 400 pounds when it is weaned by its mother. Other references, however, state the weight at 200 pounds. How might the writer have checked this conflicting information? Of course, he might have decided to write for expert information. Where might this letter be sent? _____

_____

_____

2. In the first paragraph of the research report, the writer asked whether it was too late to save the polar bear from extinction. Yet, he didn't answer that question in the report. Why? _____

_____

_____

3. Is there any indication in the research report on polar bears as to what the writer's own values are concerning the management of this animal?

Yes_____ No_____ If so, where? _____

_____

_____

4. Do you believe that the student who researched the management of polar bears did a good, thorough job? Yes_____ No_____ - Specifically cite evidence to support your own position on this.

a. _____

_____

b. _____

_____

THANK HEAVEN!
SIGNS OF CIVILIZATION!

MODULE III

USING SURVEYS, QUESTIONNAIRES, AND OPINIONAIRES IN ENVIRONMENTAL INVESTIGATIONS

Introduction

Several different research strategies can be used to study problems in environmental situations on a first-hand basis. Three of these methods are surveys, questionnaires, and opinionaires. In this module you will be introduced to each of these methods. You will study the rules governing the use of surveys and questionnaires. You will learn to distinguish between the three research strategies introduced in this module. Most important of all, you will get a chance to do research using at least one of these methods. You should find this exciting so let's get started. The objectives for Module III are on the next page.

Objectives for Module III

Upon the completion of Module III you will be expected to be able to . . .

III-1. . . . cite several environmental issue topics which lend themselves to gathering information via surveys.

III-2. . . . identify those rules which tend to control the effectiveness of survey type strategies.

III-3. . . . evaluate a completed survey and determine whether the rules governing surveys have been respected.

III-4. . . . cite several environmental issue topics which lend themselves to gathering information via questionnaires (other than the ones listed in the module as examples).

III-5. . . . write a list of rules which tend to control the effectiveness of questionnaire type strategies.

III-6. . . . cite several environmental issue topics which lend themselves to gathering information via opinionaires (other than the ones listed in the module as examples).

III-7. . . . successfully identify, from a list of 10 research questions, those items which are basically surveys, questionnnaires, or opinionaires.

III-8. . . . choose a research strategy using either a survey, a questionnaire, or an opinionaire, conduct the research and successfully communicate the data collected during that research.

Surveys

A survey is one technique that can be used to collect information about a particular environmental condition or problem. It is a first-hand means of investigating something in or near your community. How valuable it will be depends entirely on how you go about it and the quality of the data you collect.

In the dictionary you will find a definition for SURVEY something like the following:

> SURVEY: A critical inspection used to provide exact information. Often, a study of an area with respect to certain conditions.

This simply means that a survey looks for very specific information in a very particular area. The key words seem to be INFORMATION and AREA. A survey might be used to obtain INFORMATION about how many industiries are polluting the air in a PARTICULAR COUNTY (AREA) in New Jersey.

What are some other ways in which surveys could be used? Try your hand at listing two or three good uses for surveys in your own community, county, or region below: (III-1)

1. _____

_____.

2. _____

_____.

3. _____

_____.

Do each of your examples state exactly WHAT is being surveyed and WHERE the survey is to take place? If not, your examples don't contain both the INFORMATION and the AREA. Check each example to see how well you have done.

If you need more practice writing good examples of uses of surveys,

please use a separate sheet of paper and follow your instructor's directions.

What is the secret of making a good survey - one that will really be useful in collecting data that is truly worthy of your time and effort? Can you think of some rules that you should follow in making a good survey? See whether you think the rules below would be important. Judge each separately. Mark "yes" or "no" to each rule in terms of whether you think it is important. (III-2)

Important?

Yes	No	
___	___	A. Carefully decide the exact information (data) that needs collecting.
___	___	B. Specify the exact area in which the data are to be collected.
___	___	C. Collect enough data to make sure that the data really tell the story you want to tell.
___	___	D. Record all collected data carefully and completely.
___	___	E. Work out a system that will accurately communicate the data to others.
___	___	F. Make sure that any conclusions drawn from the data are correct in terms of the information already collected.

Before we give you the answers to A through F above, consider one example of a survey conducted by a group of eighth grade students in a small Midwestern city. The students realized that the downtown traffic was creating both noise and air pollution problems. But, before they could draw any real conclusions about the traffic pollution problems, they knew that they would have to have hard, cold facts to back up these conclusions. With good data, they thought they could approach the City Council and ask for help in reducing the pollution.

The eighth graders decided that they should send teams of investigators downtown to survey traffic patterns at the one major intersection (Brooks Avenue at Washington Street). They also decided that they should break the information down into certain categories that would make the data even more important when they were done.

Teams of investigators were sent to the corner of Brooks Avenue and Washington Street for a period of two days at 3:30 PM. Each team would count vehicles for one hour. The collected data would then be brought back to class

for discussion. What you see below is a summary of the data collected.

TRAFFIC SURVEY AT BROOKS AND WASHINGTON

3:30 - 4:30 PM

Cars Heading				Trucks (Any Direction)	Other Vehicles Heading			
N	S	E	W		N	S	E	W
				Tuesday				
197	141	117	203	40	8	6	5	8
				Wednesday				
181	149	97	211	32	4	4	7	8
				Averages for Tuesday and Wednesday				
189	144	107	207	36	6	5	6	8

Now, review the reasons why the class wanted to conduct this survey and get the data collected. Answer the following questions to the best of your ability: (III-3)

1. Did the students know the exact data they needed to collect? Yes _____ No _____ Reasons for your answer: _____

_____

_____

2. Did the students specify the exact area in which the data were to be collected? Yes _____ No _____ Reasons for your answer: _____

_____

_____

3. Did the students collect enough data to make sure they could tell the story they wanted to tell? Yes _____ No _____ Reasons for your answer:

_____

_____

_____

4. Did the students record the data carefully and completely? Yes _____ No _____ Reasons for your answer: _____

_____

_____

5. Were the data communicated accurately to others? Yes _____ No _____ Reasons for your answer: _____

_____

_____

You have been given no questions dealing with conclusions because no conclusions were drawn from the data.

If you answered "no" to question three and "yes" to the rest, you are probably right. You could make a case for answering "no" to question one if you wanted to argue the point. Even though this survey was an interesting one, the students didn't really sit down and think through the problem well enough. There simply is not enough information here on which to base conclusions that would have an impact on the City Council. What about the other days in the week? What about other hours in the day? Most anyone knows that traffic is heavier at certain times of the day. What would it have been like between 4:30 - 5:30 PM? Between 6:30 - 7:30 AM? Is traffic this week as heavy as during other weeks? Many questions need to be answered before the students can draw conclusions and go to the City Council.

Yes, making a good survey can amount to a lot of work. But, unless it is carefully thought out, it can prove to be a waste of time. We doubt that you want to waste your time.

The exercise you have just completed also helps you understand why ALL

of the rules stated in Exercise III-2 are important rules to follow when conducting surveys. Go back to III-2 and check your answers. Change any you had wrong. Keep these rules in mind. You will need to use them!

Questionnaires

A QUESTIONNAIRE is a very special kind of survey. The questionnaire obtains specific kinds of data from human beings. It is used to get information that can only be obtained in this manner. A definition can be found below.

> QUESTIONNAIRE: A carefully written set of questions about a particular subject that is given to a carefully selected population of human beings.

What are some examples of topics that could be investigated with the use of questionnaires? Here are a few:

1. Family size in a particular neighborhood or community.
2. Number of gasoline powered devices owned per family in a neighborhood or community.
3. Number of electrical appliances found in the average home in a given neighborhood or community.
4. Types of heating systems found in a particular neighborhood or community, e.g., natural gas, bottle gas, fuel oil, coal, wood.
5. Garbage disposal techniques used by renters and/or home owners.
6. Number of home owners recycling metal and/or glass containers.
7. Average number of pets being fed by residents in a particular area.
8. Consumption of tobacco by neighborhood or community adults and/or juveniles.
9. Annual loss, in dollars, of local merchants due to shoplifting.
10. Vandalism of public facilities and dollar costs, e.g., sports arenas, movie houses, bowling alleys, city parks.

Can you think of two or three OTHER subjects of an environmental nature that could be studied with a questionnaire? If so, state them below: (III-4)

Questionnaire 1. _____

_____

Questionnaire 2. _____

_____

Questionnaire 3. _____

_____

Let's stop for a minute and take a look at the questionnaire topics you have just written. If you wrote a questionnaire for these topics and used them in the community, would you be getting FACT or OPINION? A questionnaire collects hard, cold data - NOT opinions people have about something.

What about the topics written by other students in your class? Are they topics for data collection or are they, instead, opinion-gathering topics? If this is a bit confusing to you, go back to the 10 topics listed above and note the way in which they were written. It won't take long for you to see that these are true questionnaires and not opinionaires.

Earlier in this module you were given a list of rules to follow for making surveys. How close does this list of rules come to giving you directions for using questionnaires? (Please go back to the rules and reread them!) Rule B needs to be expanded to include the population with which the questionnaire will be used. Do you use the questionnaire with renters? Home owners? Children? College-age people? Adults? All of these people? Combinations of these? Another population perhaps? Just what IS the target population? This question must be answered.

Using the basic list of rules for conducting a survey as a reference, write a list of rules that should control the quality of a questionnaire. Do this in the space that follows. Use as many of the spaces as you feel you need. Perhaps your instructor will ask the class to produce a "master list". This list will also help you when you get to the topic of opinionaires. (III-5)

A. _____

_____.

B. _____

_____.

C. _____

_____.

D. _____

_____.

E. _____

_____.

F. _____

_____.

G. _____

_____.

H. _____

_____.

I. _____

_____.

BEN, DO YOU THINK THAT DUCK HAS AN OPINION ON OIL SLICKS?

Opinionaires

Opinionaires are very much like questionnaires except that there is one big difference. OPINIONAIRES measure the OPINIONS or beliefs of human beings concerning specific things.

Even though opinionaires deal only with beliefs or opinion, they are very important tools for doing research in environmental issues. How do people feel about littering? How many students really feel that vandalism is an O.K. thing? How many people support the use of non-addictive drugs? How many adults support the idea that zero population growth is a necessary thing? Do most citizens believe that there should be stricter controls on dog and cat owners? What is local opinion concerning strip mining? Do most adults (or students) believe that they contribute, in any way, to pollution problems? Do local citizens believe that too much of the natural environment is being used up for highways, shopping centers, and subdivisions? Where do citizens believe the new highway should be located?

You can easily see that all of the questions asked above deal with how people FEEL about something - or, their OPINIONS on something.

Let's see whether you have the idea or not. Think about local, regional, or national environmental problems on which you could get peoples' opinions. Write several of these below - as questions! (III-6)

A. _____

_____?

B. _____

_____?

C. _____

_____?

D. _____

_____?

E. _____

_____?

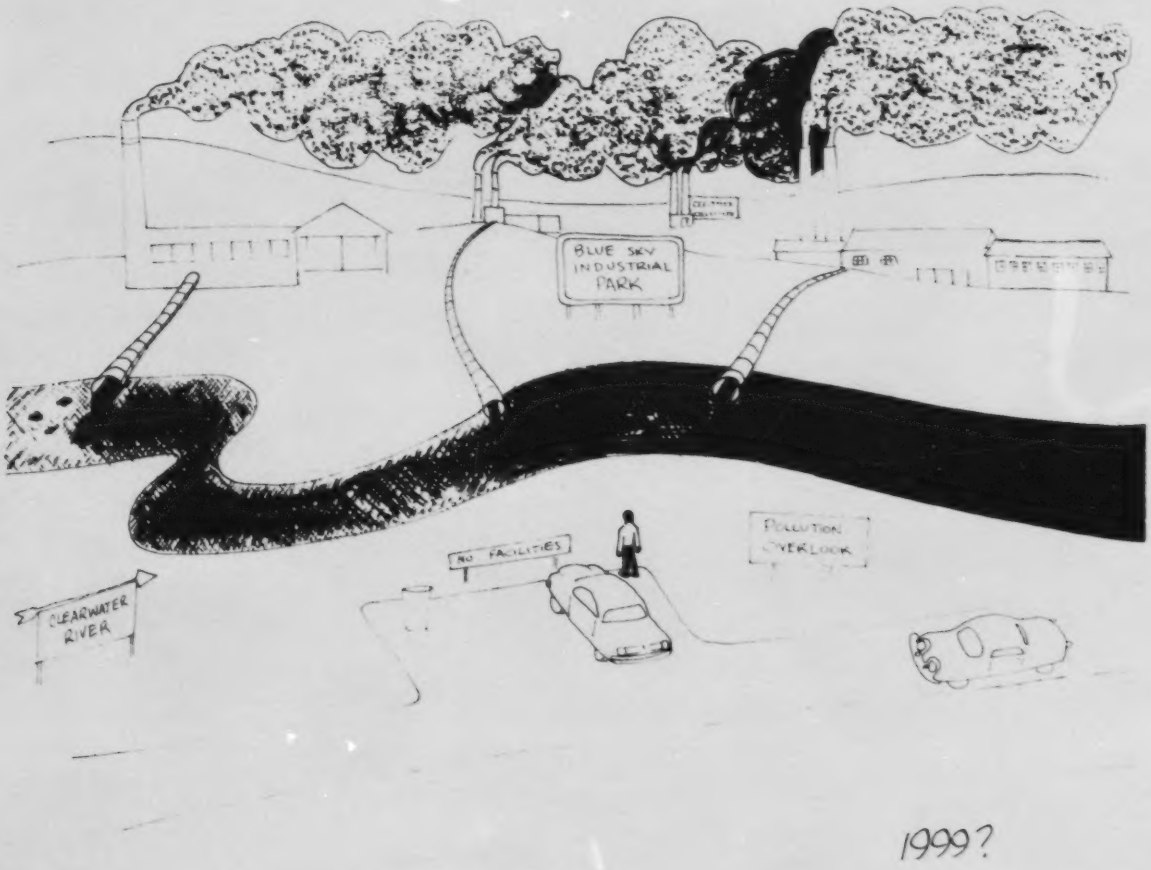
F. _____

_____?

G. _____

_____?

Evaluate your questions to make sure they deal with people's beliefs or opinions. Your instructor may ask you to share some of your ideas with other members of the class.



Self-test

After the introduction you have had to surveys, questionnaires, and opinionaires you should have a fairly good concept of each. Try the following "Self-test" to see if you have the three terms straight. In this test you will find ten questions. Read each carefully. Place an S in front of the question if it represents a SURVEY; an O if it is an OPINIONAIRE; and a Q if a QUESTIONNAIRE. (III-7)

_____ 1. How many acres of park space are set aside for each resident in this community?

_____ 2. Should wandering packs of dogs which are untagged or uncollared be allowed to roam the neighborhoods in this city?

_____ 3. Do the citizens of this community prefer having a tree and house decoration contest at Christmas (using lights) or would they prefer to conserve the electricity used in such an effort?

_____ 4. Do members of families in your community contribute to any conservation organizations? If yes, which ones?

_____ 5. How many faucets in your school building drip water? How much water is lost (in gallons) per month or per year? What is the cost?

_____ 6. What type of refuse disposal does your community have: open dumps; sanitary landfill; controlled incineration; some other?

_____ 7. If the rat population in your community increased, would you be willing to accept a tax increase in order to eliminate the rats?

_____ 8. How many areas on the school grounds show signs of soil erosion? How many could be improved with proper ground cover? How many could be improved if all students stayed on the sidewalks?

_____ 9. Should the recycling of glass and metal waste be made mandatory even if it is currently unprofitable?

_____ 10. How many domestic pets are owned by families in your neighborhood? How much is spent per month on food for these pets?

Correct responses are found below:

Correct responses for Self-test: 1. survey; 2. opinionaire; 3. also an opinionaire; 4. a questionnaire; 5. a survey type question; 6. a survey; 7. the best answer here is an opinionaire because this is asking for someone's attitude toward additional taxation; 8. a survey; 9. an opinionaire; 10. a questionnaire. How well did you do? If you got nine out of ten your concepts are probably in pretty good shape.

Doing Surveys, Questionnaires, and Opinionaires

Now we arrive at the point in this module where you actually get to do a survey, a questionnaire, or an opinionaire. On the following pages you will find a sample of each. Your instructor will divide the class into teams of researchers. Each team will do one of these investigations. Of course, there are many topics that could be researched and you and your instructor may decide to investigate still another one. This is perfectly alright. However, it is suggested that the first time you use this technique you keep it as simple as possible and still collect good data. Later on, your research can become more detailed as you choose the topic to be investigated.

When you have completed your initial research, your instructor will ask you to share your findings with him and probably, the rest of the class. These three samples are not really designed for you to draw conclusions from when you are done but you might want to try your hand at this even though you will receive special training on this in the next module. Good luck! (III-8)

MODEL SURVEY

A Neighborhood or School Survey of Trees and Shrubs

Survey (Research) Questions:

1. How many trees and shrubs exist in a given block or on the school site?
2. Where are these trees and shrubs located?
3. What kinds of trees and shrubs have been planted here? NOTE: If Question 3 presents problems for the research team it could be deleted.
4. Where should additional trees and shrubs be planted?

Survey Procedures:

1. Carefully choose the block, neighborhood, or school site to be surveyed.
2. Using the Survey Grid found on the next page (or another designed specifically for this survey), plot the locations of trees and shrubs for the chosen area.

   (NOTES: You should make certain that the dimensions of your grid correspond to the area chosen for the survey. The grid provides for a square block and shows curb strips. This may not be suitable for your purposes. Symbols can be used for various kinds of trees and shrubs and suggested symbols are found at the bottom of the page on which is located the Survey Grid. Also, you may need to enlist the help of an expert in identifying the kinds of trees and shrubs. Consider asking your biology instructor or a local nurseryman for help.

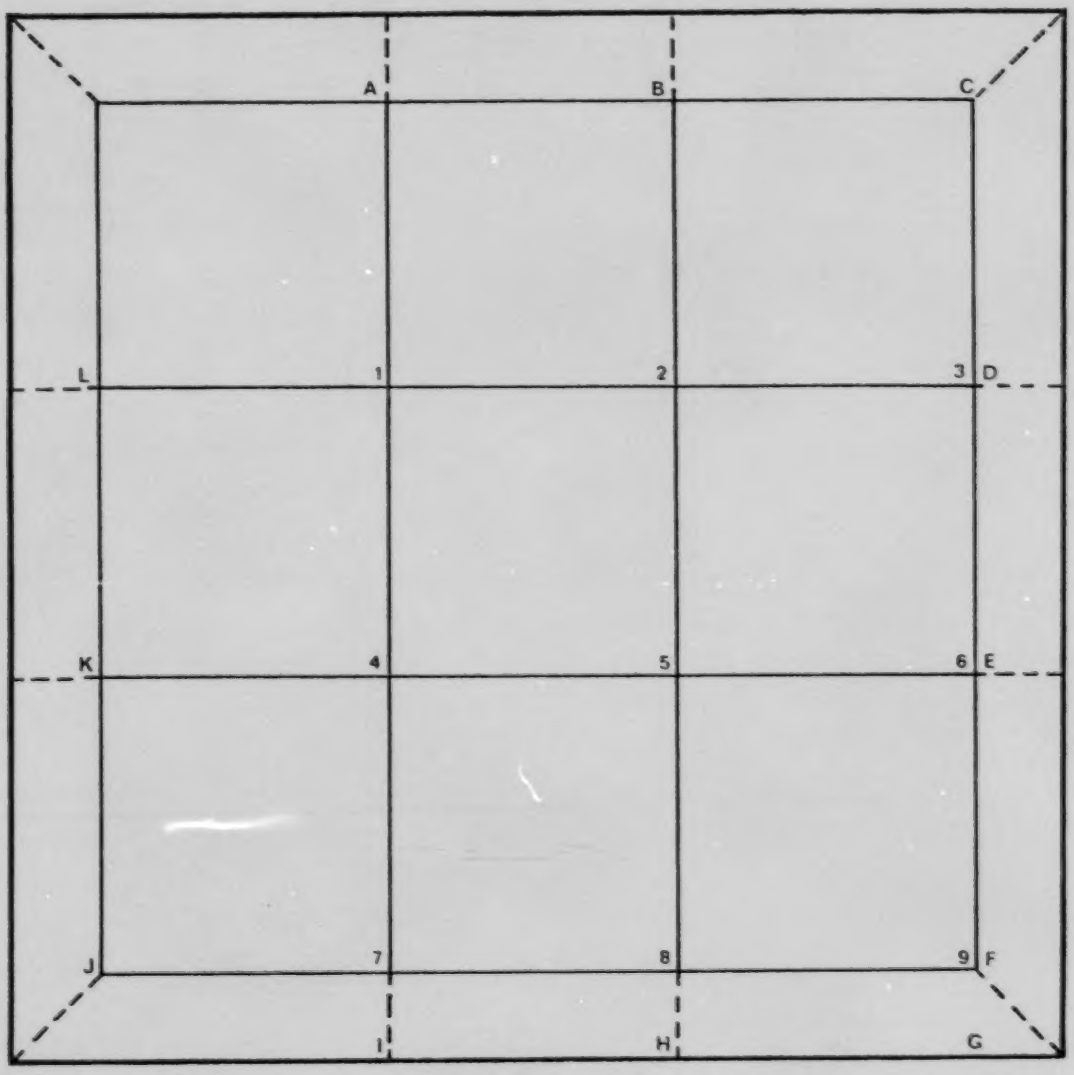
3. Summarize the data collected on the Data Summary Sheet which is provided for this purpose. If this Data Summary Sheet does not meet your needs, design one that does.
4. Carefully consider the implications that this kind of survey could have on a neighborhood or a school's administration, i.e., of what value could it be?

Neighborhood Survey Grid - Data Sheet

Exact site of survey: _____

_____

Date of survey: _____



SYMBOLS:

X = _____ # = _____ S = _____

+ = _____ θ = _____ V = _____

0 = _____ * = _____ Z = _____

DATA SUMMARY SHEET

Survey of Trees and Shrubs

	Kinds of Trees and Shrubs																	
Grid Component - Read Down!																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
A																		
B																		
C																		
D																		
E																		
F																		
G																		
H																		
I																		
J																		
K																		
L																		
Sub Totals																		

Total Trees Present = _____ Total Shrubs Present = _____

MODEL QUESTIONNAIRE

Glass and Metal Waste Questionnaire

This questionnaire is designed to yield usable data concerning the habits people have developed relative to their use and disposal of glass and metal containers. It should be used with a member of a household, preferably the person responsible for household management. If this questionnaire is used, the size of the sample gathered should be fairly large in order to make the data meaningful, i.e., over 50 responses. Similarly, it is suggested that data be collected and categorized (tabulated) according to particular parts of the community, i.e., high income, middle income, and low income neighborhoods.

+ + + + + + + + + + +

Hello, my name is _____. I am a student at _____ school. One of my classes is doing research in environmental problems and I would like to ask you a few questions about your use of glass and metal containers. May I ask you a few questions?

Person responding: Male ___ Female ___.

Address: _____.

1. How many people live in this household? _____
2. Do you purchase any part of your groceries (other than beverages like pop, fruit juice, or beer) in metal containers? Yes ___ No ___
3. Do you purchase any of your beverages in metal containers? Yes ___ No ___
4. Do you purchase any beverages in glass containers? Yes ___ No ___
5. Of those beverages purchased in glass containers, what percent of the beverages are in <u>returnable</u> glass containers? _____ %
6. Regarding metal cans, what percent of them do you take to a local recycling or collection center? _____ %
7. Regarding throw-away glass containers, what percent of them do you take to a local recycling or collection center? _____ %
8. Have you (or any member of your family) ever asked your grocer to stock beverages only in reusable glass containers? Yes _____ No _____

THANK YOU VERY MUCH FOR YOUR HELP!

Glass and Metal Waste Questionnaire Data Summary Sheet

ITEM	Population or Neighborhood A.		Population or Neighborhood B.		Population or Neighborhood C.		TOTALS	
No. Males Responding								
No. Females Responding								
Average No. People per household								
Groceries (Not Beverages) Purchase in Metal Cans	Yes	No	Yes	No	Yes	No	Yes	No
Beverages Purchase in Metal Containers								
Beverages Purchase in Glass Containers								
% of glass reusable =								
% of glass throw-away =								
% of cans thrown away =								
% of cans recycled =								
% of throw-away glass thrown away =								
% of throw-away glass recycled =								
Has any member of the family ever requested grocer to stock only reusable containers?	Yes	No	Yes	No	Yes	No	Yes	No

MODEL OPINIONAIRE

Opinions on Littering

This opinionaire is designed to collect information concerning the opinions citizens have concerning certain aspects of littering. It is suggested that samples be drawn from several segments of the population, i.e., junior high students, high school students, and adults. Data collected should be reported for specific samples. The opinionaire is set up so that it should be read to the person being surveyed. A minimum of 25 persons per sample is recommended.

+ + + + + + + + + + +

Hello, my name is _____. I am a student at _____ school. One of my classes is collecting information about how people feel about littering. May I collect information from you?

Person responding: Male ___; Female ___. Age: Jr. H. S. age ___; High School age ___; adult ___.

Questions:

1. Do you consider the littering of public and/or private property to be a problem in this community? Yes ___; No ___; Undecided ___.

2. In your opinion, does littering have any ill-effect on the beauty or aesthetic quality of this community? Yes ___; No ___; Undecided ___.

3. In your opinion, does littering have any public health impact on this community? Yes ___; No ___; Undecided ___.

4. In which of the following places in the community do you think littering is at its worst?

_____A. In the schools?
_____B. Public thoroughfares (streets)?
_____C. Shopping centers?
_____D. Other businesses, e.g., gas stations and drive-ins?
_____E. Private property?

5. What age person do you believe is the most responsible for littering?

_____A. Students below junior high age?
_____B. Students of junior and senior high age?
_____C. College age students?
_____D. Citizens over the age of 21?

6. Which of the following would you be willing to throw away on a public street, on public property, or on private property?

(IMPORTANT: These items are ranked according to the degree of the littering. If a person says "yes" to any item, stop there and GO NO FURTHER with No. 6. Merely go on to Question 7.)

_____A. A cardboard box full of empty pop or beer cans?
_____B. A sack of waste paper from a drive-in?
_____C. One empty pop or beer can?
_____D. A paper coke container?
_____E. A wrapping from a stick of chewing gum?
_____F. None of these?

7. Which of the following statements concerning law envorcement do you agree with MOST?

_____A. Law enforcement officers should ignore people who litter.
_____B. Law enforcement officers should enforce anti-littering laws only in cases of severe littering.
_____C. Law officers should enforce anti-littering laws strictly - to the letter of the law.

8. Would you ever consider reporting a severe case of littering to the police?

Yes _____ No _____

9. Have you ever reported a severe case of littering to the police?

Yes _____ No _____

10. Do you personally wish that fewer people would litter?

Yes _____ No _____ Undecided _____

11. In your opinion, what do you feel is the most important reason for the litter problem as it exists today?

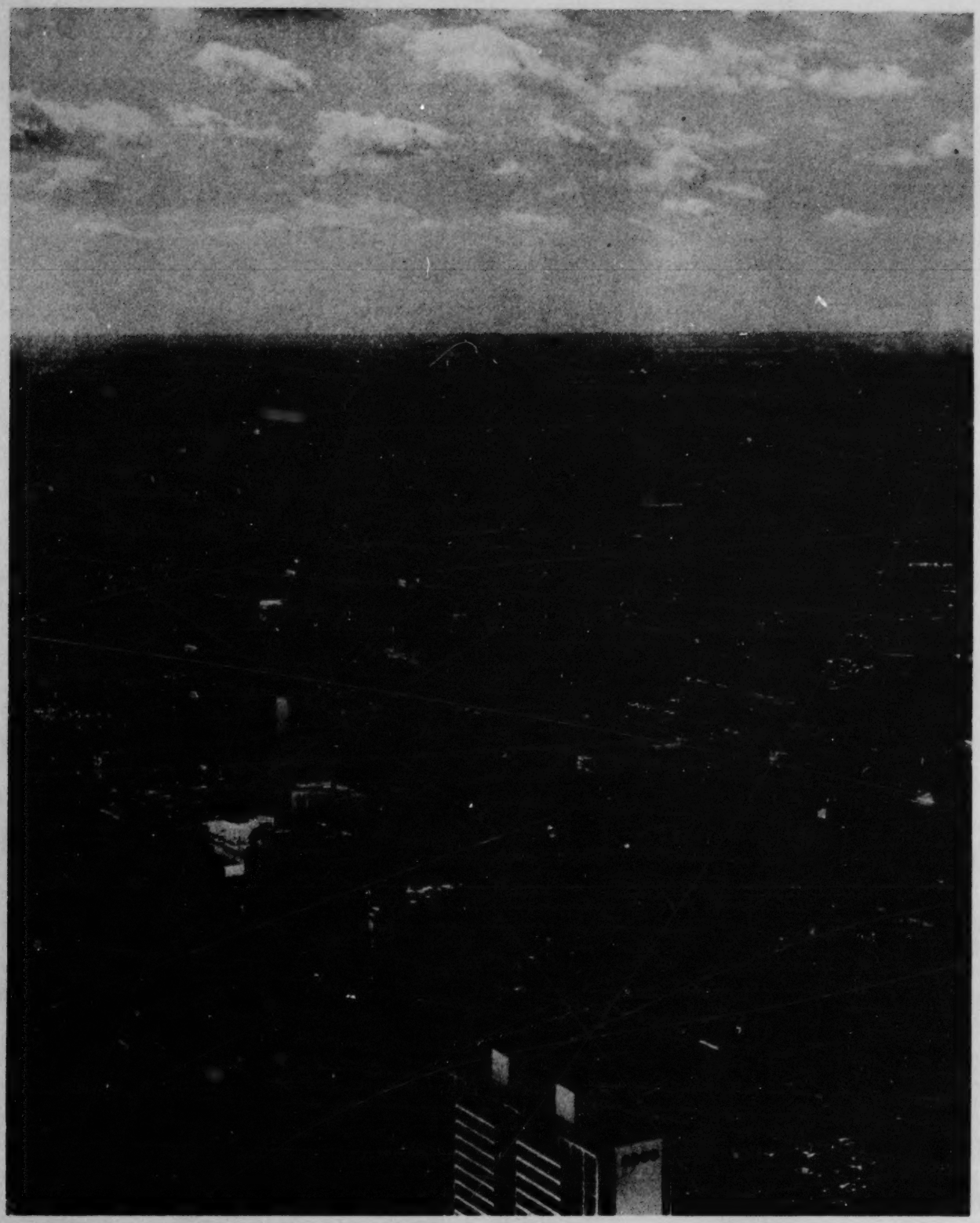
THANK YOU FOR YOUR HELP!

END

LITTERING OPINIONAIRE DATA SUMMARY SHEET

Sample Being Reported: _____

Question 1.	Yes:	Males_____	Females_____	Total_____
	No:	Males_____	Females_____	Total_____
	Undecided:	Males_____	Females_____	Total_____
Question 2.	Yes:	Males_____	Females_____	Total_____
	No:	Males_____	Females_____	Total_____
	Undecided:	Males_____	Females_____	Total_____
Question 3.	Yes:	Males_____	Females_____	Total_____
	No:	Males_____	Females_____	Total_____
	Undecided:	Males_____	Females_____	Total_____
Question 4.	Response A:	Males_____	Females_____	Total_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
	Response D:	_____	_____	_____
	Response E:	_____	_____	_____
Question 5.	Response A:	_____	_____	_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
	Response D:	_____	_____	_____
Question 6.	(Recording the first "yes" response!)			
	Response A:	Males_____	Females_____	Total_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
	Response D:	_____	_____	_____
	Response E:	_____	_____	_____
	Response F:	_____	_____	_____
Question 7.	Response A:	_____	_____	_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
Question 8.	Yes:	Males_____	Females_____	Total_____
	No:	Males_____	Females_____	Total_____
Question 9.	Yes:	_____	_____	_____
	No:	_____	_____	_____
Question 10.	Yes:	_____	_____	_____
	No:	_____	_____	_____
	Undecided:	_____	_____	_____



MODULE IV

INTERPRETING DATA IN ENVIRONMENTAL INVESTIGATIONS

Introduction

Science is sometimes called sensory reality. This means that only those things that can be observed are considered real to the scientist. The "sensory reality" definition of science does NOT cover all of what science is about. But, it does offer us some clues as to what we are able to do with information collected during research.

Information collected by the scientist must be interpreted. It won't just lie there interpreting itself. Interpretation is a human task and is no better than the skills of the person doing the interpreting. Therefore, if a person reads too much into the data he runs a serious risk of making erroneous statements as a result. It can be most embarrassing to have someone prove you wrong later on. Incorrect interpretation can also prove dangerous to the health and personal safety of human beings in environmental science. You can probably guess why this might be true.

This module is designed to help you become familiar with a few of the basic types of data interpretation. It will not cover all aspects of interpretation nor will it cover all possible situations in which you might find yourself. However, if you learn to use the rules presented, you should be able to transfer these skills to new situations without too much trouble.

Objectives for Module IV

As you interact with this module you will be expected to be able to . . .

IV-1. . . . accurately identify appropriate conclusions written for a specific environmental observation.

IV-2. . . . write both conclusions and inferences appropriate for normal, everyday happenings.

IV-3. . . . write recommendations for a sample survey based on the conclusions and inferences produced during that survey.

IV-4. . . . evaluate conclusions, inferences and recommendations written as a part of a complex environmental study. Further, you will be expected to rewrite one inappropriate inference and one inappropriate recommendation found in this study.

IV-5. . . . (a) reread the polar bear research report found in Module II and successfully evaluate that report in terms of its recommendations.
. . . (b) write one logical recommendation for the polar bear research

IV-6. . . . (a) report one conclusion and one inference that could be produced from one set of data that has been reported two different ways.
. . . (b) identify how these two sets of data differ.

IV-7. . . . successfully transfer one set of data to a line graph.

IV-8. . . . evaluate the data graphed in IV-7 and write one conclusion, one inference, and recommendations based on that data.

Conclusions

Everyone knows what a conclusion is. It's the end; the finish to a speech, a fairy tale, or a meal. A good meal concludes with desert, doesn't it? But, what about conclusions in science? What are they? How do we use them? How can we keep from making mistakes with them?

A conclusion in science is not too difficult to understand. Even so, it is easy to misuse or abuse conclusions. Lots of people do exactly that! A conclusion in science is an expression or a statement of the end result. It is the final result--the outcome.

Most people mess up conclusions when they use them to interpret the results of a study, i.e., try to explain why something happened as it did. This is NOT a conclusion; it is something else which we will go into later.

Let's see if we can help you get the idea more fully. We'll call this Exercise IV-1 and begin it with an example:

Some years ago, a scientist observed that sparrow hawks prey on and eat certain song birds such as the yellow warbler. He observed this phenomenon on several field trips at a variety of locations. (Of course, sparrow hawks prey on and eat large quantities of mice and large insects also.) The scientist wrote up his findings and made the following two conclusions:

Conclusion 1: Sparrow hawks and warblers have a predator-prey relationship in certain areas where both exist.

Conclusion 2: It appears as though the sparrow hawk may be a harmful factor in the reproduction capacity of warbler populations.

Now, how do these conclusions strike you? Do they seem logical and fitting for the scientist's observations? Put your thoughts on paper. If the conclusion seems O.K., check yes; if not, check no.

Conclusion 1: Yes_____ No_____

Conclusion 2: Yes_____ No_____

Conclusion 1 is excellent. It follows exactly the observations made by the scientist. Conclusion 2 probably resulted because the scientist felt

sorry for the warblers. It is a terrible conclusion! Why? Because it's not a statement of the results of the man's observations. It is, instead his personal interpretation of the results and goes beyond the observed data. He might infer the statement about reproduction. He might even develop a research question to investigate whether this relationship exists, but IT IS NOT A CONCLUSION.

We are not at all finished with the business of conclusions but for a little while we are moving to another term, that one being . . .

Inferences

In the dictionary you will often find that conclusion and inference are used similarly--that they are synonyms. Not true in science!! Even though some people misuse these terms we are going to ask YOU to be correct in your use of them.

An inference is an implication--an assumption or a judgement made from the data (or from the conclusions).

Conclusion 2 in Exercise IV-1 was an inference, although not a very good one. But, still, it was an inference because it was a judgement made by the scientist on the data observed.

Some experts say that an inference is an explanation of an observation. That's really not too bad a definition because it helps us remember that an observation is what we see and an inference is the explanation of the observation. A number of years ago, a famous scientist by the name of Alexander Fleming observed that certain bacteria grew poorly or not at all when in the presence of living Penicillium molds. He inferred (his inference) that there was something about the mold that kept the bacteria from growing and reproducing. This inference resulted in the development of penicillin!! Quite an important inference, wouldn't you say? But, in this example it is

rather easy to see the difference between an observation and an inference.

Conclusions and Inferences Made Easy

Suppose you and a friend walked to town one lovely summer evening and decided to go to a movie after getting there. After two hours of entertainment you leave the theater and walk out onto a wet sidewalk. Further, the streets are wet and puddles of water stand here and there. From this situation you can . . . (IV-2)

Conclude? _____

_____

Infer? _____

_____

The morning following your seeing the movie with your friend, you get up look out the window, and see a moving van backed into your neighbor's yard. What can you . . .

Conclude? _____

_____

Infer? _____

_____

A little while later you see what appears to be the driver of the moving van pouring something into the truck's fuel tank from a five gallon can. What can you . . .

Conclude? _____

_____

Infer? _____

_____

Let's see how well you have done. When you walked out of the movie theater there wasn't much you could conclude except that the streets and sidewalks were wet for some reason. But, you could infer that it had rained while you were watching the movie.

With the van backed up to the neighbor's house you could probably conclude that a moving van had backed into the yard sometime during the night or early morning. You possibly infer that the neighbors are moving.

The man at the fuel tank of the moving van might or might not be the driver, but you can conclude that someone is pouring something into the fuel tank of the truck. You might infer that the substance is gasoline.

What one thing is clear about these inferences? Yes, they are explanations of observations you have made. Something else should be clear (but it might not be). That is simply that you proved NONE of your inferences. You say this isn't important? Wait just a minute! A water truck sprayed the streets in the downtown area the night you went to the movie. The van's driver backed into the wrong yard. The man was pouring diesel fuel into the fuel tank--the truck doesn't run on gasoline.

You think you were tricked? Perhaps! But we are trying to make a point here--that inferences are NOT proof until they have somehow been tested. How do you test an inference? In the case of our examples it would have been easy. You ask a policeman if it rained while you were in the movie! You ask the neighbors if they are moving! You ask the man at the van what it is he is pouring into the truck's fuel tank! In each case, whether the person talked to knows it or not, you are testing an inference.

When an inference becomes something testable in science we call it a hypothesis. But, for now, we will leave hypothesizing out of the picture.

Would You Like to Make a Recommendation?

Don't worry, we won't forget conclusions and inferences. We will return to these in awhile. But, we are going to take just a little of your time and deal with recommendations. If you are going to do research in environmental science, chances are you are going to collect some data, based on the study. What is a recommendation? How do we go about making good recommendations?

A recommendation is a piece of advice given to a person or persons concerning some particular action or problem. It is normally something you are in favor of--something you would advise being done. In science, however, a recommendation must be consistent with the findings of the study. In other words, you must never recommend something that cannot be defended in terms of the research. Even so, recommendations often reflect a person's values (even though they can be defended by the data).

Let's try an example. Suppose a student did a survey of litter in a certain neighborhood and observed large numbers of beer cans lying around. He infers that residents of the neighborhood or passers-by (or both) throw empty beer cans around the area. His recommendation is that the City Council pass a city ordinance forbidding the sale of beer in cans! Naturally, this is a ridiculous recommendation to make (based on this study). If the student wants to get the city to forbid the sale of beverages in metal cans, he had best find another reason for making that particular recommendation.

However, what kinds of recommendations might the student make during his research report? Write at least two logical recommendations below: (IV-3)

Recommendation 1: _____

_____

_____

Recommendation 2: _____

_____

_____

Even though you don't have a lot of information about this litter survey, there are several recommendations that seem logical. The student might recommend stepped-up anti-littering law enforcement in the area. Further, he might recommend an educational program in the city to demonstrate the ill-effects of littering in the area. A recommendation that would produce at least temporary relief could result in a civic or school group cleaning up the neighborhood as a public service project.

A Serious Look at Conclusions, Inferences and Recommendations (IV-4)

What follows is a very serious exercise to see how well you can analyze a research project in terms of stated conclusions, inferences, and recommendations. This may not be an easy task. We have designed this exercise to be a true test of your perceptions of conclusions, inferences, and recommendations. The research that follows is fictional but entirely possible. The tasks at the end are for real!

Bluebird* Nest Box Preference Study (A Survey)

Research Question: Do eastern bluebirds nesting in southern Illinois prefer nest boxes facing a particular direction when all are installed around a wooded area, 1.5 meters off the ground?

Conditions: In January of 1971, twenty-four (24) identical bluebird boxes were installed on the Hiram E. Lindford farm east of Settlersville in Camel County, Illinois (see map, next page). The student conducting the study erected each on wooden fence posts, 1.5 meters above the ground. All were placed on fence lines facing wooded areas and the minimum distance between each was 30 meters. Six boxes faced in each direction, i.e., north, south, east, and west. Water and natural cover were plentiful.

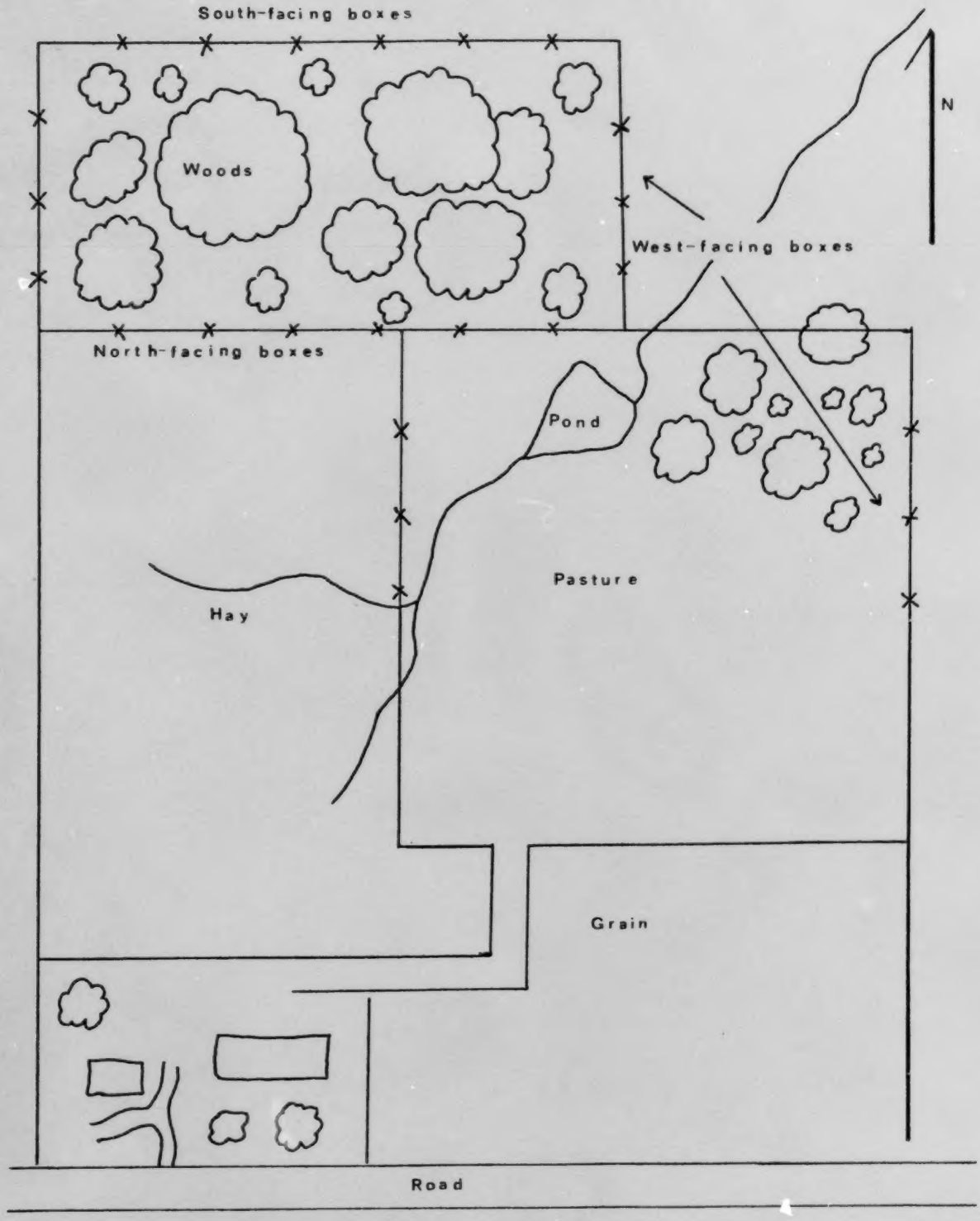
During the spring and summer of 1971 and 1972, nest boxes were visited every two weeks and inspected for active bluebird nests. Only nests which contained eggs were included in the Data Summary. Similarly, only those young birds that were reared were included in the data (Interestingly one pair of bluebirds will often produce more than one brood per year.)

The data collected can be found in the Data Summary for the Bluebird Nest Box Preference Study. Upon completion of the research, the following conclusions, inferences, and recommendations were stated:

> Conclusions: In 1971, a total of six succesful nestings were observed. From these nestings, 16 young were reared. Three nests and nine young were recorded from south-facing boxes; two nests and four young were noted from west-facing boxes; one nest and three young were observed in east-facing boxes; no nests were observed from north-facing boxes.

---

* The bluebird is an animal that many experts feel is an endangered species. It normally nests in hollow tree cavities (holes) and will not build a nest out in the open like many birds. Because forests are greatly reduced in the bluebird's range, and because there are fewer old trees with natural cavities in them, the number of nesting sites available are greatly reduced. This, then, makes the bluebird study a good example of "environmental research".



Location of Bluebird Nest Boxes On the Hiram E. Lindford Farm

In 1972, a total of seven successful nestings were observed. From these nestings, twenty young were reared. Four nests and eleven young were recorded from south-facing boxes; one nest and three young were noted from west-facing boxes; one nest and four young were observed in east-facing boxes; one nest and two young were recorded from north-facing boxes.

Data Summary

Number of Bluebird Nests and Young Reared for 1971 & 1972

Boxes placed 30 M apart	1971		1972		
	No. of Nests	Young Reared	No. of Nests	Young Reared	Total Young Reared
North-facing boxes - 6	0	0	1	2	2
East-facing boxes - 6	1	3	1	4	7
South-facing boxes - 6	3	9	4	11	20
West-facing boxes - 6	2	4	1	3	7
Totals	6 Nests	16	7 Nests	20	

Inferences:

1. The data indicate that bluebirds prefer not to use nest boxes facing north even though other environmental conditions are appropriate.
2. Of the three major directions remaining (other than north), those facing south will definitely attract and produce the largest number of birds.
3. Bluebird nest boxes facing west and east in similar situations attract and produce equal numbers of birds.

Recommendations:

1. Bluebird nesting boxes should always be erected 1.5 meters above ground on posts surrounding wooded areas.
2. Whenever possible, bluebird nesting boxes should face south. If not facing south, they should face east or west.

IV-4. What About the Bluebird Survey? First of all, you should know that there are many people who would call this piece of research an experiment. It does have some of the elements of an experiment. The research question (problem question) is asked as one might state it prior to setting up an experiment. Although no hypothesis is stated, one could be produced for this particular piece of research (although after conducting this research the researcher could produce a much better hypothesis). Further, one major variable is studied here--that being the direction in which bluebird boxes face. This also is characteristic of an experiment. Even though these factors might make this study look like an experiment, the writers prefer to call it a survey. Perhaps you will be able to tell why after completing IV-4.

In IV-4 we are going to ask you to evaluate the conclusions, inferences, and recommendations made in this study. Here goes!!

A. The conclusions: Do the conclusions stated in the bluebird study fit the rules for conclusions? Yes____ No____ Defend your answer:

_____

_____

_____

B. The inferences: Are the inferences, as stated, both legitimate and logical for the data collected?

Inference 1 - Yes____ No____ Defend your answer:_____

_____

_____

_____

Inference 2 - Yes_____ No_____ Defend your answer:_____

_____

_____

_____

Inference 3 - Yes_____ No_____ Defend your answer:_____

_____

_____

_____

C. The recommendations: Are the recommendations, as stated, both legitimate and logical for the data collected?

Recommendation 1 - Yes_____ No_____ Defend your answer:

_____

_____

_____

Recommendation 2 - Yes_____ No_____ Defend your answer:

_____

_____

_____

If a conclusion represents observable data, then the conclusions as stated are legitimate and fit the rules for stating scientific conclusions. The conclusions you evaluated are O.K.

Inference No. 1 is perfectly alright because the data do seem to indicate that bluebirds prefer not to use north-facing nest boxes even though other environmental conditions are appropriate.

Inference No. 2 is not appropriate at all as stated. Although the data do tend to indicate this (for the conditions in this study), there is no way the investigator can make this statement. It is entirely possible that variables other than direction controlled the number of nests and young reared. (The assumption that bluebirds prefer south-facing boxes and avoid north-facing boxes has NOT been proven in this study.)

Similarly, Inference No. 3 is not appropriate. Even though the data are accurate, they may have resulted as a matter of chance happenings. Would 1973 data tend to confirm 1971-72 results? Would a similar study elsewhere produce the same results. What about nest boxes erected around an open field--would the results stay the same?

You are probably bracing yourself for the comments about the recommendations. And, in fact, recommendation No. 1 simply cannot be made. Why? This study dealt only with nest boxes erected 1.5 meters above the ground. This, in no way, proves that nest boxes are most effective 1.5 meters above the ground. Even though we admire the student for installing all nest boxes the same distance from the ground, a great deal more research concerning height of nest boxes must be done before a firm recommendation such as this can be made.

Recommendation No. 2, although better than No. 1, is probably poorly written in terms of the data collected and the study as a whole. If one were to write a recommendation similar to this it should probably read: "Due to the findings of the research, this writer recommends installing nest boxes in a location where sunlight will fall on the front of the box

at least a part of the day."

Although it appears that south-facing nest boxes will produce the most birds, this is nothing more than a tentative inference based on this one study, under the limited conditions of the study. One of the major aspects of science is something called replicability. Replicability simply means that, if someone were to repeat the study, the results would be the same. Because of this, we must wait until more research has been conducted before making too many inferences and recommendations. The bluebird research should be repeated and, further, some of the variables should be studied in more detail, e.g., height from the ground, environmental locations of nest boxes.

Now seems to be a good time to point out the rigorous nature of scientific research (if you haven't gotten the message already). You may feel that the authors are much too cautious. But, this IS science and scientists simply cannot race around making wild, unproven statements. Of course, this situation also points out why it takes so long to get firm results in many fields of science. And, environmental science is one of the more difficult areas in which to work!!!

Now that we have batted a few ideas around, why don't you go back to the bluebird study and try to shape it up a bit. We are going to ask you to rewrite (modify) one inference and one recommendation in the study.

D. Rewrite Inference No. 2 to make it more suitable for this study:

_____

_____

_____

E. Rewrite Recommendation No. 1 to make it more suitable for this study:

_____

_____

_____

Recommendations for Polar Bears (IV-5)

Back in Module II you read a research report on polar bears. This was an example of a piece of research using secondary sources of information. We are going to ask you to go back to Module II and review this research report. When you feel you are ready, answer the following questions:

A. Did the author include any definite recommendations concerning polar bear management? Yes_____ No_____ Why did you answer as you did?

_____

_____

_____

Actually, we would have to say that the author of the report on polar bears did not make any definite recommendations. He came close in the last sentence but he leaves the reader with the idea that he really hasn't made a decision about whether polar bears should be hunted.

B. Should the writer of a research report done from secondary sources make recommendations? What is your opinion on this? Yes_____ No_____ Why do you feel as you do?_____

_____

_____

There is no one right or wrong answer to this question. A great deal depends upon the research topic and how it is handled. However, normally, we would urge you to make recommendations. Why? If you have researched a topic to the point that permits you to make recommendations, you have done an excellent job on the research. Further, you are now an expert on that problem, you have done a great deal of work, and you will probably want to make recommendations. The topic of polar bear management might not be an easy one on which to make recommendations but can you think of one that might have been made had you written this research report? C._____

_____

_____

_____

The writers of this module would like to suggest one recommendation that appears appropriate (this is not the only one possible).

> Polar bear management recommendation: Because research on polar bears is still quite limited and because there is serious concern for the polar bear worldwide, it is recommended that the nonresident hunting of these bears be suspended until such time as wildlife biologists can make hunting regulations based on scientific data.

You should be beginning to get the idea that the interpretation of data depends heavily on the kinds of data collected and the skills of the researcher. Further, interpretation is often limited by how the data are reported.

It All Depends . . .

Let's take a look at an example of how data interpretation can depend on how the data are reported. Back in Module I you identified problem

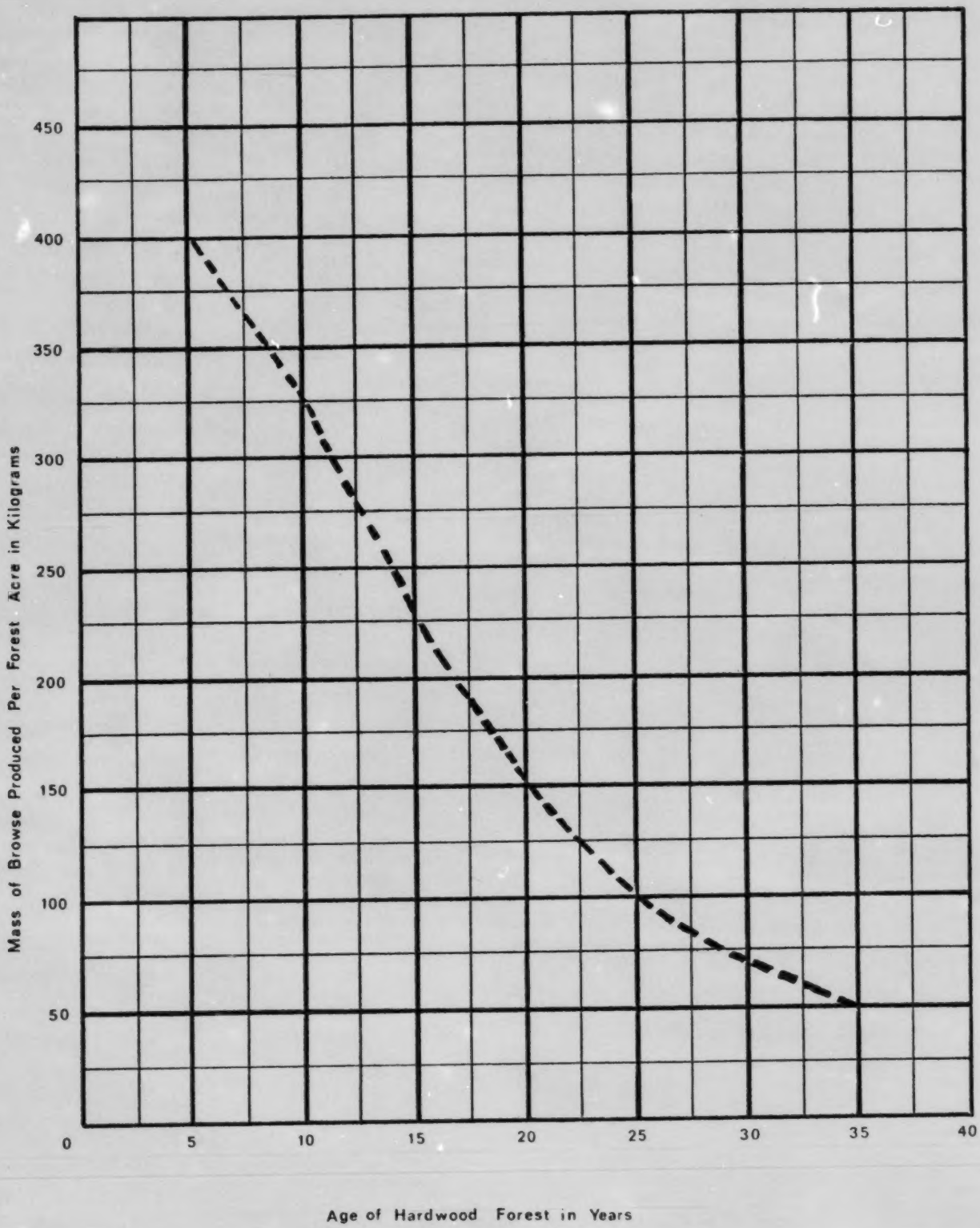
questions that related to deer management practices. You may recall reading information in that account dealing with a forest's production of deer browse. If a wildlife biologist wanted to report data concerning browse production in different aged forests he could choose several ways to do it. Two of these methods follow:

A Descriptive Account of Browse Production:

Hardwood forests produce food naturally via the process called photosynthesis. The food is then either used for growth and reproduction or stored in stems, leaves, and roots of forest trees, shrubs, and herbs.

The food that is available to deer in a forest is called browse. Browse, of course, is controlled by the height to which a deer can reach when feeding. A five year old forest (a very young forest with small trees) will produce about 400 Kg of browse per acre per year. At fifteen years of age, the production of browse is reduced to about 225 Kg per acre per year. At twenty-five years of age, browse is reduced to slightly over 100 Kg and, at thirty-five years of age, browse production falls to only about 50 Kg per acre per year.

A Graphic Account of Browse Production:



(IV-6) - Both of these techniques of reporting data communicate some of the same things. What conclusion can be drawn from both sets of data? State it here: _____

_____

Record an inference that can logically be drawn from both sets of data:

_____

_____

Now, how do the two sets of data differ? Of course, there is a definition of browse in the descriptive data which does not appear in the graphic data. But, other than this and the fact that one is descriptive and the other graphic, how do they differ? _____

_____

_____

All things considered, the graphic form of reporting is probably better than the descriptive. Why? The data show a relationship between the age of the forest and the amount of browse produced. The relationship is simply this: Younger hardwood forests produce more browse than older forests. But, reading that relationship is not nearly as effective as seeing the relationship described in a graph.

Further, the graph shows that the rate of decline in browse production is slowed somewhat after the forest reaches 25 years of age. This would permit the investigator to predict that the amount of browse in a 45 year old forest would not be a great deal less than in a 35 year old forest. Is there any way this could be predicted from the descriptive data? No!

So, how you communicate data and how you interpret it depends upon the kind of information you have and what you want to do with it. Always communicate your data in the most logical way. And, remember that how well you can interpret your data may depend on how you choose to communicate the data.

Producing a Line Graph (IV-7)

Do you think you can report data in graphic form? Graphing is a skill just like any other process. We are going to ask you to graph some very real data collected over the years about deer populations on the Kaibab Plateau in Arizona. You may be getting a bit tired of studying deer but these figures should surprise you--particularly after you see them on a line graph. Here are the data:

Deer Populations on the Kaibab Plateau from 1905 to 1938

Year	Approx. Population of Deer (In Thousands)
1907	6,000
1910	10,000
1915	25,000
1920	56,000
1923	100,000
1925	85,000
1930	30,000
1935	14,000
1938	9,000

Please graph these data using the worksheet provided on the next page. The population variable should go on the vertical axis of the graph. The year variable should go on the horizontal axis. Label both axes!

Your instructor will want to check your work on the graph. Also, he/she may ask you to do some additional tasks connected with reporting data. If so, hang in there and get the job done well. You are almost ready to be an independent investigator of environmental problems.

One Last Task - An Evaluation (IV-8)

Using the Kaibab Plateau deer population data given by the graph, write out the best possible conclusion that can be drawn from the data:

_____

_____

_____

Now, we will tell you that, between 1907 and 1923, 300 coyotes and 600 mountain lions were killed on the Kaibab Plateau. For the years between 1907 and 1923, write the best possible inference you can from all the data at your disposal. _____

_____

_____

_____

Lastly, we tell you that, during the years of increasing and decreasing deer populations, the range of the deer was so badly overgrazed that thousands upon thousands of deer died from starvation. What logical recommendation(s) would you make based on all available data?

_____

_____

_____

_____

_____

The earth as a life-support system is deteriorating. This the reader must understand clearly, in case he hasn't noticed or has been persuaded otherwise. In some respects our children's world will be better than ours, but on balance it will be uglier, less interesting, and more dangerous. This is not a pleasant fact to face, but denial is not a sufficient response to the problem.

R. Thomas Tanner - 1974

MODULE V

STUDYING AN ENVIRONMENTAL PROBLEM

- Its Your Move -

The time has arrived! Its time for you to come to grips with an environmental topic and problem of your choice. You will remember that several months ago, we told you that you were going to get to choose a problem and study it yourself. You should be able to do this now. You should have a set of skills that you can apply to a problem of your choice.

Now you have the opportunity to pick a particular problem and look into it and become an expert. In what are you interested? Is it a problem connected with population? Pollution? Pesticides? Energy production? Land use? An endangered species? Sewage disposal? Wild rivers? Game bird management? Wilderness preservation? Littering? Zoning for conservation purposes? Urban sprawl? Just <u>what</u> is it that looks to you to be important for study?

Remember, whatever it is you choose to study, focus on something that you can be successful with. Choose the right strategy for investigating the problem in which you are interested. And don't - whatever you do - DON'T try to investigate <u>all</u> endangered species or <u>all</u> of the problems connected with pollution. That's an impossible task! Choose your area of study and write out a very specific research question.

Let's see how well you can do with a research question of your own choice. On this page you will find space to pose this question. There will also be space to revise that research question if necessary. GOOD LUCK!

V-1. THE PROBLEM OR TOPIC YOU CHOOSE: Write out the problem or topic of your choice below:

V-2. THE RESEARCH QUESTION: Write the research question below:

V-3. RESEARCH QUESTION EVALUATION: Your instructor will want to discuss your research question with you at this time. Note any comments or suggestions he/she has in this space.

V-4. FINAL RESEARCH QUESTION: If a revision of the question is necessary, rewrite it here.

V-5. TECHNIQUES I PLAN TO USE IN STUDYING THE PROBLEM: Check one or more!

Secondary Sources_____ Survey Technique_____ Questionnaire_____

Opinionaire_____ Other_____ (If "other", please explain below.)

V-6. MY CONTRACT - Name _____

Class _____ Instructor _____

Final Research Question:

I hereby contract with my instructor and further guarantee that I shall use all of my mental ability and those skills in which I have been trained in order to successfully investigate the problem chosen and the research question stated above. Further, I guarantee that my independent investigation will be conducted in a manner as to give me pride in myself and to respect the rights of other human beings.

I understand that my research will be evaluated on a raw-score basis and that my final grade for this project will be based on the number of points earned. Further, I have read the following breakdown of possible points and understand how I will be evaluated.

Criteria	Points	Points Awarded
Quality of research question	10	_____
Strategy (techniques) used in investigation	20	_____
Seriousness of approach to research	10	_____
Quality of data collected	20	_____
Accuracy of conclusions	20	_____
Quality of inferences	20	_____
Accuracy and organization of final report	25	_____
Class presentation	25	_____
Grand Totals	150	_____

_____
Signature of Student

_____ _____
Date Signature of Instructor

_____
Signature of Witness

MODULE VI

ENVIRONMENTAL ACTION STRATEGIES

Introduction

In Module VI you will have an opportunity to learn how to use most of the strategies involved in environmental action. Many students and adults are unhappy with a variety of environmental problems. But, they don't know how to go about helping to solve these problems. Environmental ACTION is the key to these solutions. Only when citizens have the skills needed to take ACTION will solutions be found for many issues.

If you were successful with Modules I through V, you are certainly an expert in investigating environmental issues. Probably, there are issues in which you have become very interested. As a citizen, you would like to help solve these issues. The skills presented in Module VI will help you do exactly that.

Objectives for Module VI

Following your work in Module VI you will be expected to be able to . . .

VI-1. . . . define positive, negative and passive environmental action.

VI-2. . . . identify at least two reasons why it is difficult to classify a particular environmental action as passive, positive, or negative.

VI-3. . . . propose one example of an environmental action which could be classified as either positive or negative and defend both of these classifications.

VI-4. . . . define the action method of PERSUASION and identify at least two examples of strategies which could be used in this category.

VI-5. . . . define the action method of CONSUMERISM and identify at least two examples of strategies which could be used in this category.

VI-6. . . . define the action method of POLITICAL ACTION and identify at least two examples of strategies which could be used in this category.

VI-7. . . . define the action method of ECOMANAGEMENT and identify at least two examples of strategies which could be used in this category.

VI-8. . . . identify two advantages of group action which individual action cannot accomplish.

VI-9. . . . identify at least three categories of group action and name one organization which represents each category.

VI-10. . . given any of the thirteen action analysis criteria, explain why an individual should consider these before taking any type of environmental action.

VI-11. . . given a specific example of an environmental action, apply the thirteen action analysis criteria listed in Module VI, providing logical answers to each of the thirteen questions.

VI-12. . . identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

VI-13. . . produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows the appropriate guidelines for persuasive action.

VI-14. . . describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

VI-15. . . . list the three stages leading to environmental action at which persuasive action may be aimed.

VI-16. . . . identify three different modes of persuasion and explain how each can best be put to use.

VI-17. . . . select a product and perform both an ENVIRONMENTAL COST and a NEEDS ASSESSMENT on the product. Further, a recommendation must be made as to whether action should be taken regarding the product.

VI-18. . . . identify three categories of consumer action and describe issues in which each form of action is appropriate.

VI-19. . . . describe three kinds of political action and discuss how each of them may be effectively applied to environmental issues.

VI-20. . . . identify three situations in the local area which could require ecomanagement type actions.

VI-21. . . . apply all of the action skills and knowledge in developing a plan for action concerning some environmental issue. This would include identifying and summarizing the issue, identifying and evaluating possible actions, and making a final recommendation concerning action on the issue.

What Is Action?

In the quiet, southern Illinois town of Murphysboro, a man drives his car across a railroad track and throws a beer can away . . . in Utah, a rancher hires a helicopter and shoots eagles out of the air . . . in Louisiana, a well known governmental official is discovered buying alligator hides from poachers . . . at a Midwestern state park, college students entertain themselves by throwing glass bottles against a canyon wall . . . on a back road in Kentucky, a man pulls his pickup truck over to the ditch and calmly pushes an old washing machine into the weeds . . . on the east coast, a large utility company lies to the public about the environmental effects of its waste water . . . in Brazil, wild cats are killed, skinned, and the furs smuggled into the United States to be made into coats.

These are a few actual accounts of environmental action. They all appear to have one thing in common. What seems to be common to all of these examples of environmental action? Please respond below: (VI-1)

_____

_____

_____.

It would appear as though many kinds of environmental actions are NEGATIVE - or, not in the best interests of the environment. You say that this is a value judgment on the parts of the writers? Indeed, it is!

There are probably three different kinds of environmental action. These can be classified as follows:

1. Positive Action: This would be an action that helps to improve or maintain the quality of the environment.
2. Negative Action: This would be an action that somehow decreases the quality of the environment.
3. Passive Action: This could just as well be called "no action" because it neither supports nor hurts the environment.

Every citizen, every day, takes one or more of these kinds of environmental actions. It's not always easy to decide what the results of an action

may be, so sometimes it's hard to classify a particular action. Why is this true? Simply because people often disagree about their personal rights and about the effect of a particular action on the environment.

As you already know, environmental problems are produced because people have CONFLICTING VALUES - those personal rules of behavior which help us make decisions that will gain some desired outcome. On one hand, a man throws his beer can on the railroad tracks - on the other hand, another person believes that this violates his right to have a clean environment. On one hand, an oil corporation president decides that producing less heating oil will force prices up and increase his company's profits - on the other hand, a congressman believes that there ought to be a law against such practices to protect the consumer. On one hand, there are countries in the world that still send whaling fleets to sea - on the other hand, many nations believe that whaling is not necessary and that the great whales should be protected. On and on . . .

Conflicting values are always involved in environmental problems. Because of this, the writers take the position that an environmental action must be weighed in terms of its total effect on the environment. This is not always easy. Perhaps a short exercise will help demonstrate this.

(VI-2) Classifying Actions. As noted earlier, there are three kinds of action - POSITIVE, NEGATIVE, AND PASSIVE. Using the symbol (+) for positive, (-) for negative, and (O) for passive, code each of the following environmental actions in terms of how YOU would classify them. When finished, see if your classification agrees with those prepared by others in the class. If it doesn't, why doesn't it?

(+); (-); (O)	The Action
_____	1. A college coed goes home for the semester break and leaves her pet dog free to roam in the community.
_____	2. A movie star buys a leopard coat costing thousands of dollars.
_____	3. A rural land owner realizes that his old car can't be repaired and pulls it into the weeds behind the barn.
_____	4. A housewife buys pop in nonreturnable bottles.

_____ 5. An apartment renter throws garbage away in a rusted-through garbage can in the alley.

_____ 6. A fisherman buys beer in aluminum cans. They will be sunk in the lake when empty.

_____ 7. A neighborhood gardner makes a compost pile out of grass clippings, fallen leaves, and organic garbage. Sometimes it smells.

_____ 8. In order to get better mileage, the neighborhood mechanic bypasses the pollution-control device on his car.

_____ 9. Instead of letting the faucet run to get cold water, an elderly lady keeps a jar of water in her refrigerator for drinking purposes.

_____ 10. A young couple decides that they want a large family because they love children.

Some of the above are tough to classify when the rights of the citizen are weighed against the good of the environment. Yet, these are the kinds of questions that have to be answered by every citizen each and every day.

Just because it is sometimes difficult to classify environmental actions, this does not mean that one shouldn't attempt to do it. It does mean, however, that you should begin thinking in terms of the consequences of action! Below you will find one example of one individual's idea of a positive environmental action.

****

Negative or Positive?

The following is taken from the May 1974 issue of Audubon, p 107. How would you judge this environmental action?

> One man's protest against nuclear powerplants made headlines on Washington's Birthday. Instead of chopping down a cherry tree, Samuel H. Lovejoy - a 27-year old college graduate and organic farmer - toppled a 500 foot tower being built in connection with a $1.3 billion Northeast Utilities nuclear powerplant at Montague, Massachusetts. Unlike the Fox - an anonymous conservation commando who committed acts of vandalism against polluting industries in the Midwest but was never caught - Lovejoy made his point by cutting the guy wires that held up the tower and immediately surrendered to police. In a four-page typed statement, he took full responsibility for the sabotage, which he hoped would set people to thinking about the dangers of nuclear power. He did elicit reactions: Many young people were for him; most conservative New Englanders were shocked, and conservation groups deplored this kind of protest and disassociated themselves from it.

What do YOU think? Positive? Negative? Passive (neutral)?

****

Important Assumptions

This module is designed to help you learn about and develop skills for taking environmental action. The writers have made certain assumptions which should be communicated to you. These assumptions are:

1. You have the right to be heard and to act on environmental issues.
2. You have knowledge of environmental issues and are willing to take some sort of action concerning them.
3. You have the ability to investigate environmental problems and get enough information on which to base a plan of action.
4. Most of the actions you take have some environmental consequence. You have the responsibility to decide whether an action will be positive or negative over the long run.
5. You have the ability to become skilled in at least some of the methods of environmental action.

The Methods of Action

If the assumptions listed above are correct, you will want to know something about the METHODS of environmental action. If we analyze all of the available strategies for action, we find that most of them can be grouped under four headings.

Action Method I - PERSUASION: PERSUASION is used when someone or a group of people are trying to convince others that a certain course of action is correct. How many times in your life have you tried to convince someone that your position is the right position? This takes PERSUASION to be effective, particularly if that person or group doesn't agree with you at first.

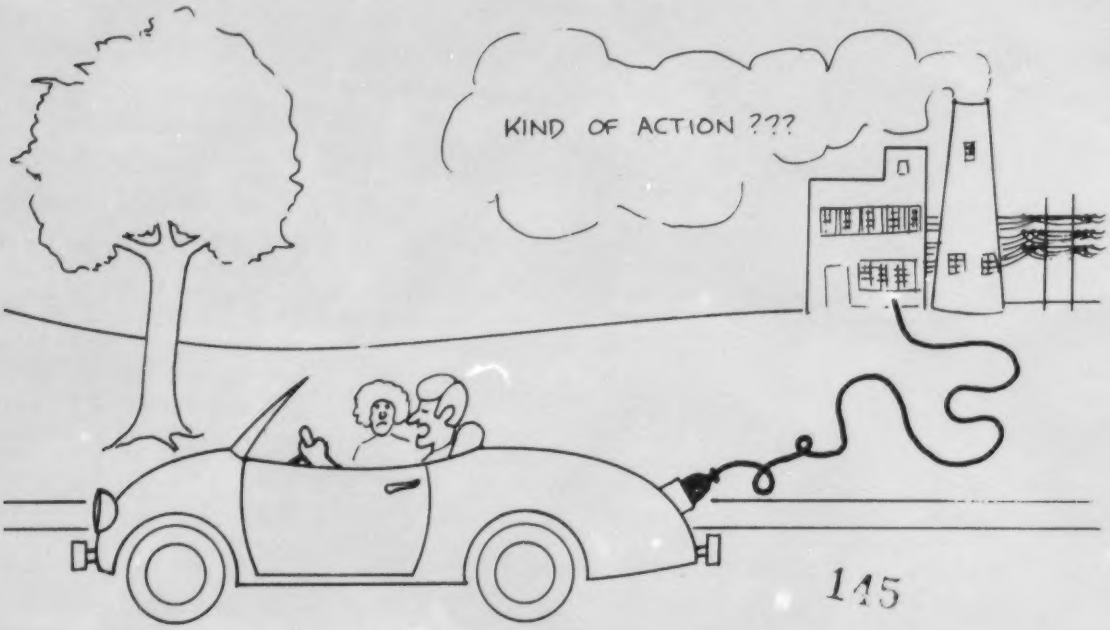
Action Method II - CONSUMERISM: CONSUMERISM relies on the power of the pocketbook or billfold. It involves buying something that agrees with one's philosophy or NOT BUYING something that represents an action or an idea one disagrees with. Consumerism is particularly effective if a group of people get together to take action. Even so, some individuals act alone in this dimension. Examples of consumerism? Refusing to buy soft drinks unless they

are in returnable bottles. Rufusing to purchase articles made in a foreign country that supports a negative environmental policy. Buying products made by companies who try to reduce environmental pollution.

Action Method III - POLITICAL ACTION: POLITICAL ACTION refers to any mode of action that brings pressure on political or governmental agencies and/or individuals in order to persuade them to take positive environmental action. In democratic nations, political action usually means supporting candidates who have positions similar to your own. It means pressuring people in office with letters, telegrams, and phone calls. It means casting a vote for or against a particular issue . . . and more.

Action Method IV - ECOMANAGEMENT: ECOMANAGEMENT is simply a word used here to describe any PHYSICAL ACTION taken with respect to the environment. It can be illustrated by examples ranging from picking up someone else's litter to helping a private agency buy and preserve an ecologically-important forest. Ecomanagement, hopefully, results in either maintaining a good environment or improving a weakened environment.

These four methods of action are the ones that will be considered in more detail later. However, before getting into these methods in depth, there are some other things to consider. Let's take a look at these, beginning on the next page.



I HAD IT CHANGED OVER TO ELECTRICITY IN ORDER TO CONSERVE GASOLINE!!

Individual vs Group Action

Each of the methods described above may be put into practice in one of two ways. These are: (1) by individual action and, (2) by group action.

The writers of these modules have often heard people say, "I can't do anything about environmental problems because I am just one person!" This is NOT true! There are many ways for the individual to take action - by himself or by cooperating with private and public organizations. It IS true, however, that an individual cannot do ALL things. It is also true than an agency cannot do all things. It takes both!

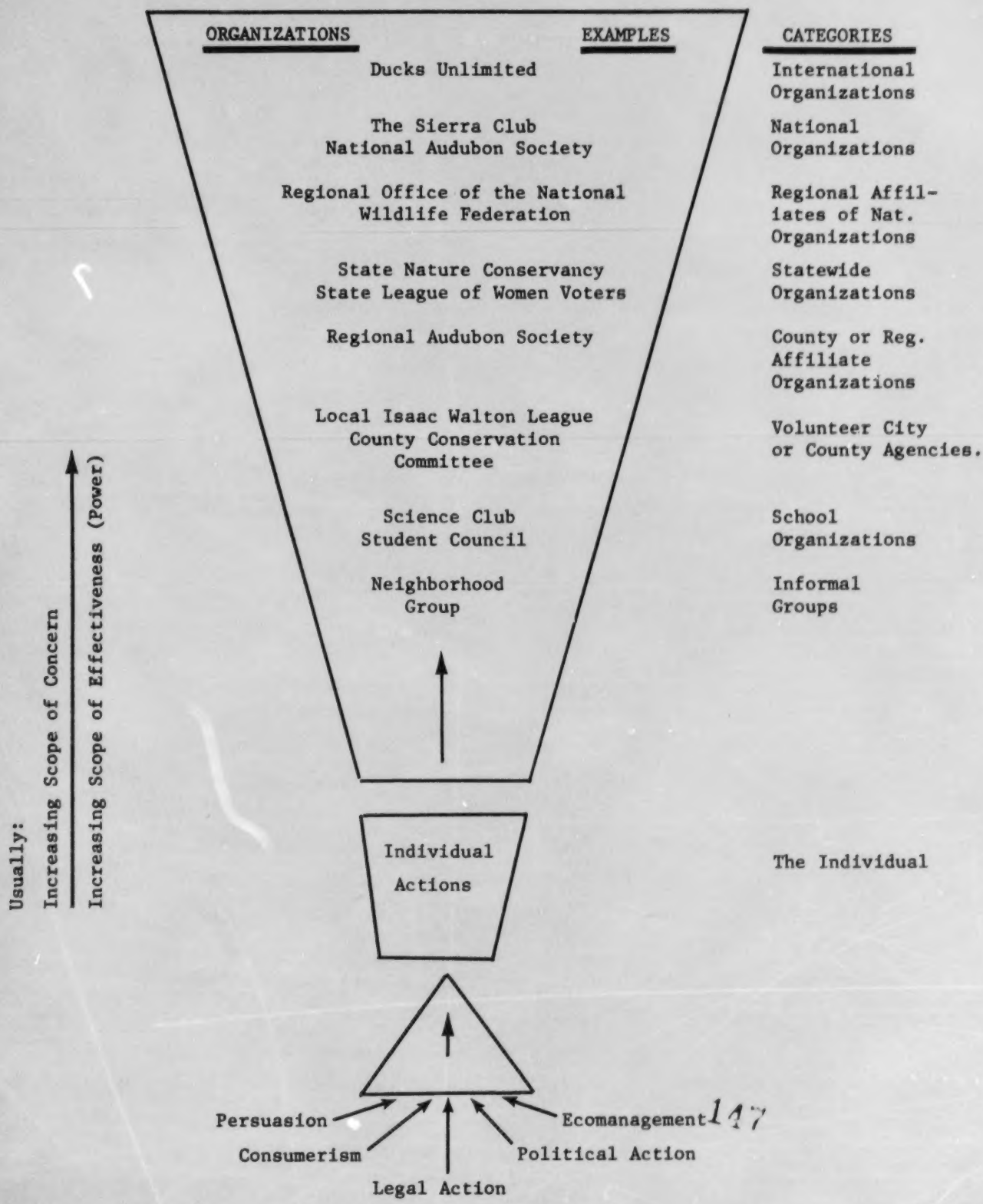
In any event, both individuals and groups can take all four of the modes of action described earlier, i.e., persuasion, consumerism, political action, and ecomanagement.

Following this page, you will find a rather complicated diagram. It shows different LEVELS of environmental action - from individual action through the group action sponsored by international organizations. As you read upward, you will find that the actions (and groups) represent larger and larger geographic areas. This also indicates that the SCOPE of the action also increases. However, this is not always true. There are times when the action of one individual or the actions of one small group can have greater impact than the actions of larger organizations. Generally, though, it is true that the most power for action lies with the well-organized and powerful groups.

It is also important to realize that groups are nothing more than individuals working together. Even international organizations such as Ducks Unlimited, get their power to act (and their financial resources) from individual human beings, some 150,000 of them. Organizations are no better nor effective than the sum total of INDIVIDUALS belonging to that group - whether a school's student council or a national conservation organization.

Many human beings are active both as individuals and as members of groups. Membership in environmental action groups has advantages other than broadening the individual's scope of action. For example, one function of most enviromental groups is to keep the individual members well informed on

Levels of Environmental Action and Decision-Making
Individual and Organizational



important environmental issues and to provide suggestions for appropriate action. This benefit alone increases the effectiveness of the individual wishing to take environmental action. Paying dues or making donations to action groups also allows the individual to support action strategies which he could not take alone because of limitations of personal skills and/or financial resources.

Even so, it is not the intent of the writers to tell you that you should be active either as an individual or as a group member. The intent, instead, is to let you know how to be active and to give you the necessary skills. The rest is up to you!

Guideposts for Decision Making

Many, many individuals take environmental action - both negative and positive - without the least knowledge of where their actions will lead This is unfortunate because one should not get on any bandwagon before he/she thinks it through.

How does a person make a decision about whether to take an action? It's not particularly easy if done correctly.

Let's assume that you want to take action on an environmental issue that concerns you. Can you think of some QUESTIONS concerning the action that you ought to ask yourself before proceeding?

A few spaces are provided below. Write down those questions that you think need answering before a particular (any) action is taken. (IV-3)

1. _____

_____?

2. _____

_____?

3. _____

_____?

4. _____

_____?

5. _____

_____?

6. _____

_____?

Putting Up Bluebird Boxes in Southern Illinois. (Photo courtesy of Harold R. Hungerford.)

For many years the eastern bluebird was threatened with extinction due to a loss of nesting habitat. At this point in time the bluebird is slowly increasing in population. Student groups such as this one have helped in the comeback of bluebirds by building and installing nest boxes in appropriate places.

What type of environmental action is this? Is there a need for a similar project in your area? How could you find out?

Recycling Cans in Florida. (Photo courtesy Harold R. Hungerford.)

Many environmentalists would argue that recycling aluminum cans is not as effective as using returnable bottles in the first place. Returnable glass bottles require less energy to make, use a more abundant resource (sand), and reduce the litter problem. Producing cans from aluminum ore has a very high environmental cost in terms of energy and this cost is reduced considerably by using recycled aluminum. Until returnable bottles replace aluminum cans on the market shelf, the environmental actions depicted by this photo are necessary to lessen the many problems created by cans.

Do you have a recycling center or pick up facility in your community? What environmental actions do you think might reduce the "metal can problem" in your area?

Action Analysis Criteria

The authors have identified a total of thirteen questions that seem important to ask before proceeding with an environmental action. See if your's agree with those that follow:

1. Is there SUFFICIENT EVIDENCE to warrant action on this issue?
2. Are there ALTERNATIVE ACTIONS available for use? What are they?
3. Is the action chosen the MOST EFFECTIVE one available?
4. Are there LEGAL CONSEQUENCES of this action? If so, what are they?
5. Will there be SOCIAL CONSEQUENCES of this action? If so, what are they?
6. Will there be ECONOMIC CONSEQUENCES of this action? If so, what are they?
7. Do my PERSONAL VALUES support this action?
8. Do I understand the PROCEDURES necessary to take this action?
9. Do I have the SKILLS needed to take this action?
10. Do I have the COURAGE to take this action?
11. Do I have the TIME needed to complete this action?
12. Do I have all of the OTHER RESOURCES (other than the above) needed to make this action effective?
13. What are the ECOLOGICAL CONSEQUENCES of this action?

Have you identified a question that should be asked by someone who intends to take action that is not on this list? It might be an excellent one if you have. Discuss it with your classmates and your instructor.

It is important to determine whether each separate mode of action should stand the test of these guideposts to action (Action Analysis Criteria). How do you feel about this? On the basis of what you now know, ask yourself whether actions grouped under PERSUASION, CONSUMERISM, POLITICAL ACTION, and ECOMANAGEMENT should stand the test of these questions. Below, you will find four columns of spaces. Beside each row of spaces you will find the question. Put a check in each space that seems to apply.

This activity begins on the next page. (VI-4)

* - Persuasion

* - Consumerism

* - Political Action

* - Ecomanagement

The Questions

___ ___ ___ ___ 1. Is there sufficient evidence to warrant action on this issue?

___ ___ ___ ___ 2. Are there alternative actions available for use?

___ ___ ___ ___ 3. Is the action chosen the most effective one available?

___ ___ ___ ___ 4. Are there legal consequences of this action?

___ ___ ___ ___ 5. Will there be social consequences of this action?

___ ___ ___ ___ 6. Will there be economic consequences of this action?

___ ___ ___ ___ 7. Do my personal values support this action?

___ ___ ___ ___ 8. Do I understand the procedures necessary to take this action?

___ ___ ___ ___ 9. Do I have the skills needed to take this action?

___ ___ ___ ___ 10. Do I have the courage to take this action?

___ ___ ___ ___ 11. Do I have the time needed to complete this action?

___ ___ ___ ___ 12. Do I have all of the other resources needed to make this action effective?

___ ___ ___ ___ 13. What are the ecological consequences of this action?

___ ___ ___ ___ 14. Your's, if different from the above: _____

_____?

Did you leave any of the blanks unchecked? If so, why did you choose to do so?

Applying the Criteria: (VI-5) It seems both wise and interesting to apply the action analysis criteria to specific environmental action strategies. On page 136 of this module, there is a report of how one man protested the building of a nuclear power plant. Pretend that YOU are Mr. Lovejoy and the time is a few weeks before you plan to topple the 500 foot tower. You come across the action analysis criteria questions seen above. Ask each of these questions in terms of what you are thinking about doing - destroying the tower. What might the answers look like? Do you still think you would go ahead with your plan? Why?

Your instructor may provide you with additional action problems for you to inspect by applying the criteria questions. In any event, the writers of this module hope that these questions make sense to you. They also hope that you will refer to these questions whenever you think about taking an environmental action.

A Closer Look at the Modes of Action

ACTION METHOD I - Persuasion as an Environmental Action.

Persuasive action is a part of practically every environmental action. An environmentalist must first select an action he/she feels is necessary and correct. Then, others must be persuaded to join in the action so that it can be effective. People can be convinced to take a specific action by appealing to their sense of logic and/or some emotion. Sometimes legal means are used to COERCE (force) people who cannot be persuaded.

Taking persuasive action of all three types places a heavy responsibility on the environmentalist to be sure his/her own reasons for taking action are sound and in the best interests of all concerned. Let's take a closer look at the three approaches to persuasive actions: LOGICAL, EMOTIONAL, and COERCIVE.

Making Logical Appeals

Persuasive actions of this type have long term effects, but are perhaps the most difficult to carry out successfully. Presenting a factual set of reasons for taking a particular action requires that the logic be well thought out and accurate, as well as being presented in a clear and convincing manner. Also, it must be remembered that what is reasonable to you may not be so reasonable to someone with a different set of values or different educational background.

This type of conflict between values is very clear in the nuclear power issue. Nuclear power has been proposed as a safe, clean, and available source of electricity. Environmentalists have taken the position that nuclear power is not clean because it adds small amounts of radioactive waste to the air and builds up solid radioactive wastes which must be disposed of. Environmentalists also point out that an accident in a nuclear power plant could have catastrophic results in death and damage, even though the chances of such an accident do seem small. Even the availability of fuel is questioned in terms of whether the amount of radioactive fuel will last long enough.

Both sides are dealing with the same data. In the final analysis, their differences lie in values. Therefore, the logical arguments they make from

the same data are different. Those who desire the energy and economic security of nuclear power are willing to take the risks of ecological problems. Most environmentalists prefer the risk of economic problems over ecological ones.

Unless new and important information becomes available on issues such as this, persuasive action will be difficult for either side.

Making Emotional Appeals

There are cases where environmentalists (or other activists) feel strongly that their action is a positive and logical one, but for various reasons choose to use an emotional appeal rather than a logical one to persuade others. For example, an environmentalist may feel an issue is too complicated for many people to understand, yet wishes these people to participate in his/her chosen action. Another reason for emotional appeals is that time is too short for a thorough, logical treatment of the issue.

Used by itself, an emotional appeal can be a very effective - but dangerous - means of getting immediate actions by some people. The danger occurs when activists use such tactics to serve their own selfish or poorly thought out purposes.

It would be nice to believe that emotional appeals are ineffective because people do not take actions without carefully thinking about them. Unfortunately, such is not the case. People often take action without giving the matter enough thought.

Perhaps few areas of environmental concern are as filled with emotion as the area of endangered wildlife. One good example of this is the issue of protecting feral (wild) burros in the California desert. Feral burros are the descendents of burros which escaped from early prospectors and travelers in the early 1800's. By the 1900's the burro population had risen to a high level and some people began to hunt them for use as commercial dog and chicken food. The killing of these "sweet and innocent" looking animals created an emotional outrage among many animal lovers. A strong appeal was made to state legislators to pass laws protecting the burros. Eventually this emotional appeal succeeded.

This decision was, however, a bad one ecologically. The California desert

is a very delicate ecosystem. It has taken the desert's plants and animals thousands of years to become adapted to life there. One of the large animals of the desert is the bighorn sheep. It has feeding habits which cause it to travel over a large part of the desert. This traveling prevents one area or one type of desert plant from being eaten too heavily. Also, this animal has a very low rate of reproduction which keeps its numbers low.

The burro is not a native to the desert. It does not have habits which protect the desert it lives in. It has few, if any, natural enemies. Without controls, the large burro population is not only causing the bighorn sheep to disappear by competing for its food, it is destroying the desert ecosystem as well. This problem is definitely a serious environmental issue. And, it is one where there is a good deal of emotion on both sides.

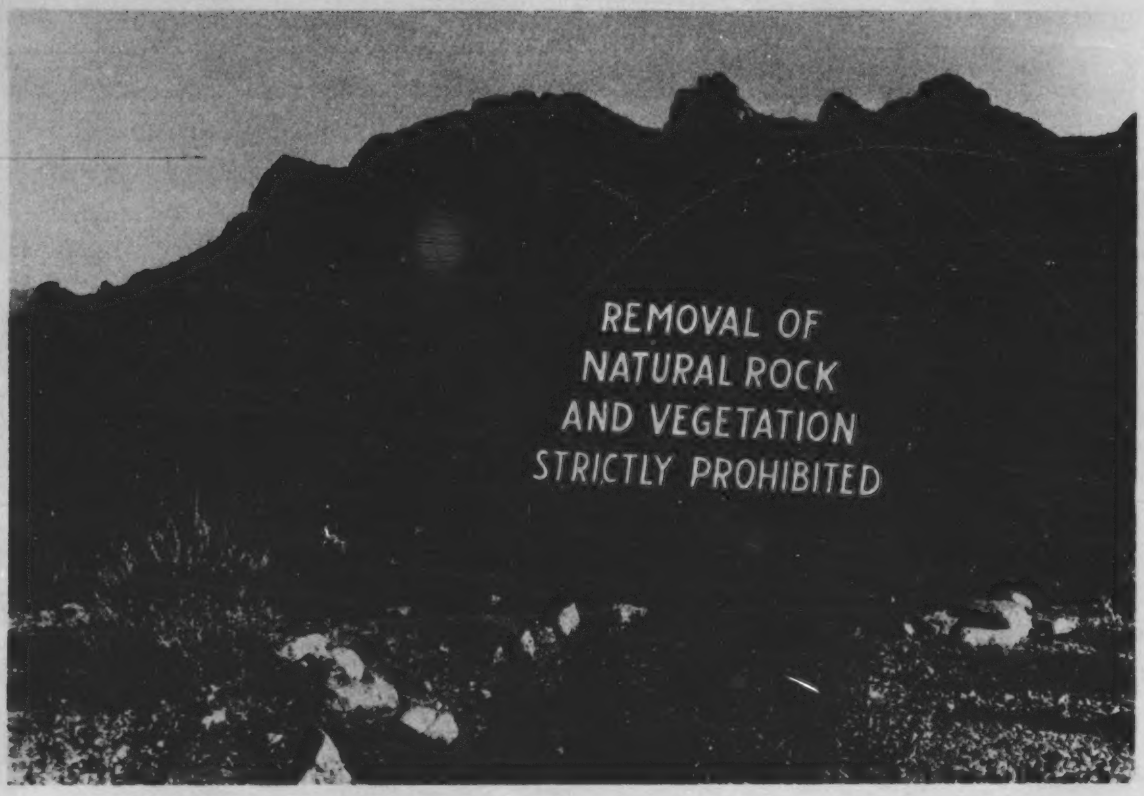
Other emotional issues involve the wild mustangs of Nevada, the harvesting of young seals in the arctic, the killing of elk in Yellowstone National Park, and protecting the elephant populations of Africa. In many cases the need for protection is real! However, there is obvious danger in acting on the basis of emotional persuasion without getting all of the facts. These types of issues show how important it is to consider all of the criterion questions when selecting environmental actions.

Coercion

COERCION is not really persuasion since it FORCES people to act in certain ways rather than allowing them to make their own decisions. However, it is briefly considered here because it is sometimes used.

There are always some people who cannot be persuaded to act in the best interests of others unless they are forced to do so. For this reason, societies have laws and punishments to coerce the correct or desired behavior.

Environmentalists can use such laws to force others to take positive environmental actions. Other types of actions such as consumer boycotting also may be used to coerce others. (Consumer boycotting will be considered later in this module.) Coercion, when used, can have serious consequences. Because of this, it is important that the person planning to use coercion checks the action against the thirteen criteria questions seen earlier.



Saguaro Cactus Forest in Arizona. Photo courtesy of Harold R. Hungerford.)

What type of persuasive action is being used here to prevent people from taking a negative environmental action? Since several thousand visitors come to this area each year, what would be the effect if EACH PERSON took home a cactus plant and a rock?

There are some interesting questions that could be asked about this situation. Why is it necessary for the park officials to put this sign up in the first place? Many people visit this area without taking rocks or plants. Why don't ALL PEOPLE leave the rocks and plants where they are? What must be done to permit these kinds of signs to disappear from public places? Will this ever happen? Why?

The authors feel that the best approach to persuasive action is a logical argument which helps others decide to take positive environmental action. Certainly, presenting a logical case can be made more effective if it is made in such a way that it appeals to the values (or emotions) of others. However, logical reasons should always be considered as well as emotional reasons for taking action.

Whatever persuasive action you choose, it probably will deal with one or more of the following strategies:

1. Making others AWARE of the need for action.
2. Helping others UNDERSTAND the need for action.
3. Getting others to VALUE the need for action.

To illustrate these stages as they lead to action, consider the issue of high phosphate detergents. Many housewives used detergents containing large amounts of phosphates which eventually fertilized rivers and lakes, causing an overproduction of plants. (This process is called EUTROPHICATION.) Eventually, this process caused severe water pollution problems.

In the late 1960's environmentalists began a campaign to make people AWARE of the problem. The next step was to help housewives UNDERSTAND the biological and chemical nature of the problem and to point out alternatives. Another part of the campaign told of the VALUE of clean water in our lakes and streams. As a result of this persuasive campaign, many people boycotted high phosphate detergents and manufacturers began looking for less damaging detergents to put in the supermarkets.

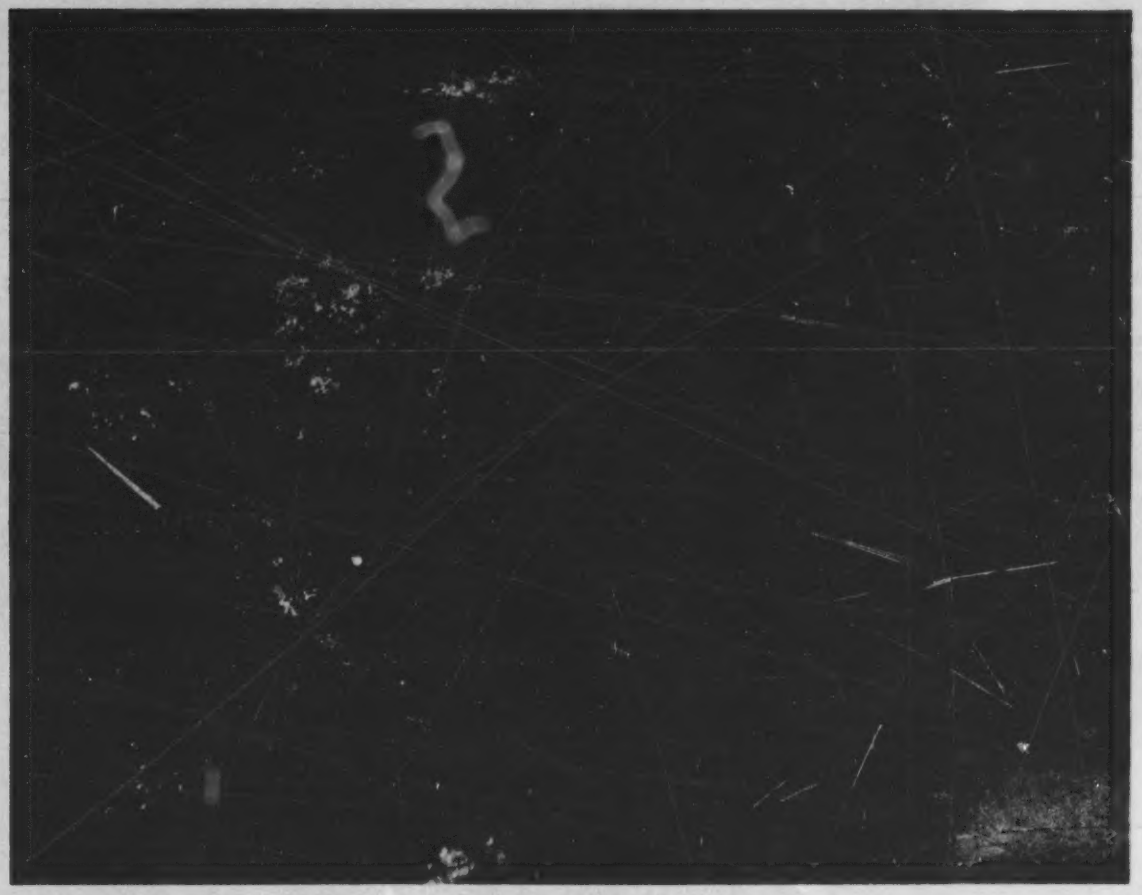
This is not the entire phosphate story, nor did environmentalists use only these kinds of actions. However, it does serve to illustrate the stages of persuasive action. Again, the key words are AWARENESS, UNDERSTANDING, and VALUING.

Many different methods exist which can be used at EACH of these three stages. A brief description of how some of these may be used follows:

> Posters, newspaper ads, radio announcements, etc.: These are usually brief, eye-catching modes which serve best at the AWARENESS level. They may also be used to appeal to the VALUES of others. Their effectiveness in providing extensive UNDERSTANDING of the issue is limited.

Verbal discussions, speeches, letter writing, debates, newspaper and magazine articles, etc. These modes are useful in ALL THREE STAGES, especially in presenting the facts on an issue.

Modeling behavior: When one person takes action and others observe the action, it may serve to PERSUADE them to do likewise. Picking up litter or using trash cans in the hallway would be an effective example of modeling behavior. This method can serve very well to make others AWARE of an issue, and even to make them check their own VALUES.



Pond Eutrophication. (Photo courtesy of Harold R. Hungerford.)

This closeup of a part of a pond shows the effect of fertilization on the growth of algae. Fertilizer in the form of nitrates and phosphates washed into this farm pond. The dense mats of green algae and the other small organisms in the murky water are the result of these chemicals in the water. When the algae die what do you think will be the effect on the oxygen supply in the pond? The decay of dead plants uses up a lot of oxygen. What could happen to the fish population? Are there any bodies of water in your area which are the victims of this form of water pollution? If so, what could be done about it?

Guidelines for Persuasive Action

There are some guidelines which should be followed to make persuasive action more effective. If you can add others, write them below in the spaces provided.

1. Be sure the basic argument can be easily understood by those being persuaded.

2. Be certain the case being presented is accurate, and the facts are correct.

3. Show how the desired action fits the values of others.

4. Select a method of persuasion which is clear, interesting, and appropriate to the issue.

Can you add others?

5. _____

_____.

6. _____

_____.

How About Persuasive Letters?

To refresh your memory on proper letterwriting, refer back to Module II. The general form of the persuasive letter is the same. Since letter writing is a common form of persuasive action when trying to get good environmental laws passed, the following guidelines are suggested for use when writing politicians. You may want to keep some of these in mind when writing persuasive letters to others as well.

1. Begin the main body of your letter with Dear Senator _____, Dear Representative _____, or Dear Governor _____.

2. In the first sentence, state the issue and how you wish the legislator to vote on the issue. When referring to a specific bill, be sure to use its name and number.

3. It is best to limit each letter to a single issue.

4. Present the issue as briefly as possible. Describe your position and why you hold it. If you have detailed information to provide, organize the letter so that the reader does not have to wade through this in order

to understand the meaning of your letter. Often it is best to attach detailed descriptions to the letter as appendices.

5. Never include disrespectful comments. Do not begin with statements like, "I know you won't read this but . . ." Be objective and courteous, never threatening.

6. Express your pleasure with any positive actions taken by the legislator or official. Often it is wise to devote a whole letter to praising some action taken which represents your interests. This lets the legislator or official know he/she is on the right track.

7. Include a full return address so the legislator can respond.

(VI-6) Classifying Actions: Refer back to the reprint on page 136 of this module - the one describing the actions of Sam Lovejoy and the "Fox". While they may be ecomanagement actions, they are also of a persuasion type. Classify the persuasion approaches taken by these two activists. Classify them as LOGIC, EMOTION, or COERCION. Defend your choice of classification.

Sam Lovejoy - Type: _____

Defense: _____

_____

_____

_____.

The "Fox" - Type: _____

Defense: _____

_____

_____

_____.

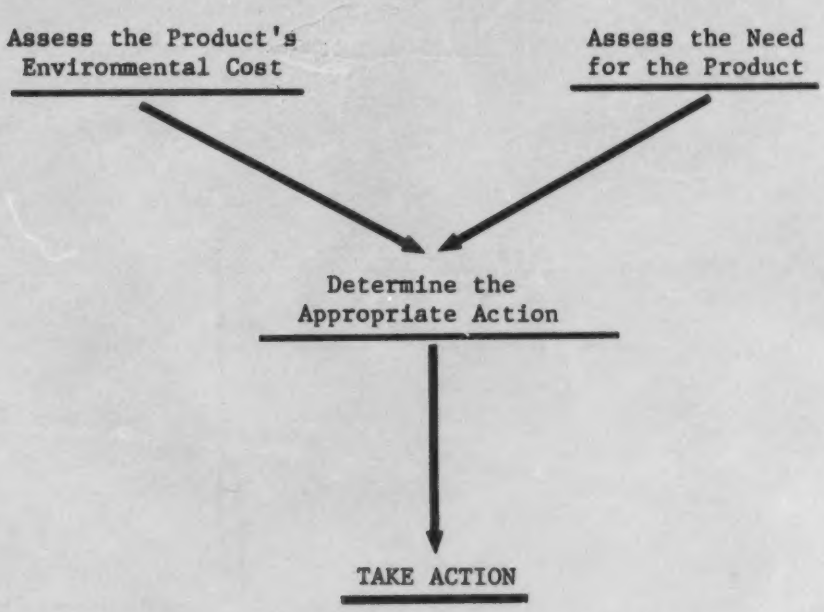
ACTION METHOD II - Consumer Action.

As consumers of services and products, we take consumer actions every day which effect our environment. Consider the following list of products. Most of these you probably use at least occasionally.

1. pop in disposable cans
2. electric hair dryers
3. plastic sandwich bags
4. automobiles
5. refrigerators
6. hamburgers in disposable containers

Certainly, you could add many other products to the list which you consume and/or use. Are the effects of these products on the environment negative or positive?

Actually, it is nearly impossible to classify a product as completely good or bad for the environment. Instead, a comparison must be made between the harmful effect the product has on the environment (ENVIRONMENTAL COST) and the NEED for the product. The flow chart which follows suggests an approach which can help in selecting a positive consumer action.



Assessing Environmental Costs of Products

Assessing the damage a product may do to the environment is not an easy task. To help in making an assessment of environmental cost, a list of questions is presented below. Consider each of these. As an example of how the questions may be used, they are applied to the disposable pop can.

1. Is the product made from natural resources which cannot be renewed?

   FOR POP CANS: Pop cans require a number of metals in their manufacture. Since metals cannot be replaced once they are mined from the earth, the answer is definitely YES, they do require non-renewable resources.

2. When the natural resource (or product) is taken from the environment, does it change the environment in any permanent and undesirable way (damage the environment)?

   FOR POP CANS: Metal for producing cans must be mined. Mining operations always have a measurable effect on the environment. The wastes produced by the mine may pollute water ways; the earth is often scarred permanently. Of course, there is also the matter of the energy it takes to remove minerals from the earth.

3. If the change (damage) is not permanent and can be repaired, is it being repaired?

   FOR POP CANS: Unfortunately, much of the damage remains because repair (recovering the mined land and cleaning polluted waters) is so expensive.

4. Does the manufacture, transport, and/or storage of the product damage the environment?

   FOR POP CANS: The transport of canned pop is no more destructive to the environment than transport of bottles. However, the manufacture of pop cans causes pollution - air as well as water - and uses tremendous amounts of energy. This is especially significant, since the can is intended to be used only once.

   In 1971, the energy involved in making and transporting pop (and beer) containers exceeded the combined energy needs of 15 countries in Africa, Asia, and Central America. Throw-away cans require three times as much energy as returnable bottles to make, use, and dispose of.

5. Does the use of the product damage the environment?

FOR POP CANS: The actual "use" of the can does not.

6. Does the disposal of the product after use pose a problem for the environment?

FOR POP CANS: This is one of the biggest problems with pop cans. Since it is not yet economical to recycle the metals in pop cans, most will be thrown away.

Americans consume over 380 soft drinks per person per year. About 65% of these come in non-returnable cans and bottles. That means that millions of cans will end up either as litter in the environment or as solid waste in a landfill or other garbage dumps.

Pop Can Assessment Summary

A summary of the pop can assessment might appear as follows:

Question	Cost Assessment of Pop Cans
1	High
2	High
3	High
4	Very High
5	None
6	Very High
7	High

Total Assessment Decision: The pop can represents a high cost to the environment.

Assessing Product Need

Even when an environmental cost assessment has been made for a product, a consumer decision cannot be made until the NEED for the product has been determined. Below are three guidelines for assessing product NEED. After you have read and thought about them, apply these guidelines to determine your need for pop cans.

Guidelines for Assessing Product Need

1. Does the product serve a real need? An imagined need?

2. Are there environmentally desirable (or at least less damaging) substitutes available?

3. Do you value the benefits of the product greater than the costs to the environment?

(VI-7) Assessing the Need for the Pop Can. Answer each of the above questions with respect to your personal need for the pop can. Some space has been provided for your reasoning.

Question 1: Does it serve a real need? _____. An imagined need? _____. Reasoning: _____

_____

_____.

Question 2: Environmentally desirable substitute available? _____.

Reasoning: _____

_____

_____.

Question 3: Do you value the benefits of the product greater than the cost to the environment? _____. Reasoning: _____

_____

_____

_____.

How do your responses compare to those of your classmates? Do your responses reflect your values in any way? Your classmates? How?

Types of Consumer Action

Most consumer action can be classified under three headings: DIRECT BOYCOTTING, CONSUMER CONSERVATION, and INDIRECT BOYCOTTING. Let's briefly consider each of these and how they could be applied.

Direct Boycotting: BOYCOTTING means to avoid buying certain products for some reason. In this case, a product is avoided because it has been found to cost the environment more than it is worth. Non-returnable pop bottles, for example, have been found to have a high environmental cost. Since there are acceptable substitutes (returnable bottles) which have a much lower environmental cost, the need for non-returnable bottles is not really high. In this case, an environmentally concerned citizen would avoid buying pop unless it was in returnable bottles. If enough consumers did this, soft drink manufacturers would be forced to produce more of the ecologically sound returnable bottles and discontinue the others.

Consumer Conservation: In some instances, a product may be found to have a very high environmental cost, but also a high needs assessment. A total boycott would not be an acceptable environmental action because of social,

economic, ecological or other consequences. An example of such a product is electrical energy.

Our society could not function without electrical energy. Yet, the effects of energy production on the environment are great. Whether electrical energy is produced from oil, coal, gas, or nuclear materials, serious problems are created in the environment. These problems arise from mining, transportation, and/or air and water pollution.

An environmentalist conserves energy by using only what is necessary. Ways to prevent waste are investigated and used. This is CONSUMER CONSERVATION.

Indirect Boycott: When a consumer uses direct boycotting, it is to eliminate the environmental cost of the product itself. However, boycotting a product can also be used to bring pressure on a company or individual to take an action other than with the product itself (INDIRECT BOYCOTTING).

For example, environmentalists boycotted all Japanese goods in an effort to convince Japan that the harvest of endangered whales should stop. This action was known as the "Save the Whales" boycott and helped convince Japan to consider changing its whale harvest procedures.

ACTION METHOD III - Political Action

Environmentalists are finding that some of the most effective actions they can take are political actions. Many decisions which influence our environment are made by government. Politicians must strive to consider all interests and values in finding the compromise answers which will be best for the most people - now and in the future.

Environmentalists can help to make sure their interests and values are considered by taking an active part in the political decision-making process.

Essentially, POLITICAL ACTIONS involve the skills and tactics of PERSUASION discussed earlier. The key is knowing how, when, and where to apply those persuasion skills in the political system. This requires a good understanding of how the political decision-making process works at the local, state and federal levels.

Some of the major political actions which could be taken and a brief discussion of them is presented below:

> Voting: This is the most obvious and easily used political action. When environmentalists organize their votes they can elect representatives who have environmental interests, or get officials out of office who have shown no concern for the environment in their decision-making.
>
> Campaigning: Organized environmentalists have shown themselves to be very influential when they campaign for or against the election of some individuals. Political campaigning may involve the donation of time, money, or other resources to influence the election process.
>
> Lobbying: Lobbying is the term used to describe actions you might use in trying to persuade politicians to make a specific decision. Often lobbying actions involve contacting politicains by letter, telegrams, or in person to persuade them to vote for or against a proposed bill. When lobbying efforts are organized, these campaigns are very effective environmental actions.
>
> Another form of lobbying involves the hiring of individuals who spend all of their time trying to influence politicians. Most large industries and organizations have full-time lobbyists. However, only a few environmental groups have enough money to afford professional lobbyists.

All forms of political action are important means of maintaining or improving the environment. To be able to use these actions effectively, you must be knowledgeable about the political process. This means using sources of information which will keep you informed on the law-making process, the environmental values of politicians running for office, and important issues that are currently being considered by government. Public news media - T.V., radio, newspaper - can keep you informed. Another vital source of information are environmental organizations such as the National Audubon Society, the Sierra Club, or the National Wildlife Federation. These groups often organize letter-writing lobbying campaigns which can make your individual effort more effective.

ACTION METHOD IV - Ecomanagement

ECOMANAGEMENT rquires a positive physical action which will improve or maintain some part of the environment. The selection of the action should involve careful consideration of the thirteen criteria questions. For example, some individuals might feel that damming a small stream to produce a pond would be an improvement in the environment. However, a close look at the ecological consequences may show more harm than good.

Below is a short list of ecomanagement actions that you might wish to consider. As you read the actions, check off those you feel might be used in your own area. If you think of others, add them on the lines provided. Many are possible! (VI-8)

Erosion control projects _____

Cleaning up neighborhoods or business districts (litter control) _____

Starting a recycling center _____

Conducting a scrap drive _____

Landscaping the school grounds _____

Improving wildlife habitat with projects such as . . .

- Habitat planting projects _____
- Installing and servicing bird feeders _____
- Building and installing nest boxes for birds such as bluebirds and wood ducks _____

Preserving important habitats for plants and animals that are native to the area _____

Planting evergreen windbreaks to conserve energy during the winter _____

Improved conservation practices in the home such as . . .

- Turning off lights when not in use _____
- Repairing leaky faucets _____

Putting weather stripping
around doors and windows _____

Lowering the thermostat _____

What other ecomanagement projects can YOU think of? Make a list below:

1. _____.

2. _____.

3. _____.

4. _____.

5. _____.

6. _____.

Spraying for Mosquitoes - West Coast of Florida. (Photo courtesy Harold R. Hungerford.)

This is a form of ecomanagement which is intended to improve the environment. From what you have learned about environmental action, do you agree that this action will have ONLY positive ecological consequences? Why?

Applying Environmental Action Skills

We have looked at the many aspects of environmental action. It is time to see how to apply them to environmental problems. This is not an easy task. But, it is important for you to see how the many aspects of action can be applied to a particular issue.

The example we are going to use in this section is the issue of the pop can - one with which you may be very familiar. There is far more to this issue than can be included in this section. However, we will present enough information to show you how to go about applying the action skills. Let's get started.

I. Identifying the Problem:

FOR POP CANS: Should the disposable pop can be used by consumers? If not, what actions should be taken?

II. Summary of the Issue:

FOR POP CANS: Both positive and negative positions should be identified and described. This is the only fair way in which the issue can be summarized. The following is an attempt to do this.

In Support of Cans	Opposing Cans
Pop cans are convenient containers.	Pop cans have a high environmental cost.
Cans are safer than glass bottles.	There are acceptable substitutes available in returnable bottles - the product need is low.
The economy is already geared to the marketing and use of non-returnable cans.	Cans can also be dangerous when rusted and/or disintegrating in the environment.
Jobs will be lost by the change-over to returnable glass bottles.	New jobs will be created and workers can be retrained.

III. Conclusions:

FOR POP CANS: From the environmentalists' position, pop cans cost the environment far more than they are worth to society. Action should be taken on this issue.

IV. Appropriate Actions:

Two general actions are possible. One is to encourage and participate in consumer boycotting of beverages in non-returnable containers. The second action is to persuade a state legislator to sponsor a bill which would outlaw disposable beverage cans and place a mandatory deposit on all pop bottles. This political action could be followed by further lobbying efforts to support the bill and get legislators to pass it into law. (NOTE: Some states such as Oregon and Michigan have already passed such laws and other states are beginning to consider the need for such laws.)

Both of the above types of action will have to be taken by both individuals and organized groups. To be effective, some state-wide as well as local environmental organizations must be willing to participate and money must be made available.

The actions will have to be taken at local, regional, and state levels. A total persuasion campaign, state wide, will be necessary to inform the public and generate their support.

V. Applying the Thirteen Criteria Questions: (FOR POP CANS)

1. Is there sufficient evidence to warrant action on this issue?

   The comparison of cost and needs assessments would indicate "yes". COST, of course, refers to the environmental cost.

2. Are there alternative actions available for use?

   A compromise action might be to develop a government supported recycling program to see that all cans are recycled. However, at this time, only aluminum cans can be economically recycled and the environmental cost is still high. Most pop cans are NOT made out of aluminum.

3. Is the action chosen the most effective one available?

   Experience in other states which already have such a law indicates that both consumer boycott and political action are effective.

4. Are there legal consequences of this action?

   Not if the actions taken are legal ones.

5. Will there be social consequences of this action?

   Certainly an effect on the habits of the people will result. But, this should be positive.

6. Will there be economic consequences of this action?

   In local areas jobs will be affected for short periods of time when a change from cans to bottles occurs. Also, some temporary effects on local supermarkets will be felt. Experience in other states indicates that the effects are temporary. In fact, more jobs are created in the long run and people can be retrained to make bottles instead of cans in factories.

7. Do my personal values support this action?

   The action fits the values of the authors.

8. Do I understand the procedures necessary to take this action?

   This depends. This module has only introduced you to the procedures. They will probably have to be developed in more detail if you choose to act on this particular issue.

9. Do I have the skills needed to take this action?

   This also depends. However, organized environmentalists share the necessary skills. By working with a group, you immediately benefit from that group's skills.

10. Do I have the courage to take this action?

    In some communities where can manufacturers are located, feelings might run very high AGAINST taking these actions. Therefore, the answer to this question might depend on where you live.

11. Do I have the time needed to complete this action?

    This also depends. A great deal of time and commitment will be required to complete these actions.

12. Do I have all of the other resources needed to make this action effective?

    Experience in other states indicates resources can be found if the environmentalists are organized. Therefore,the answer depends on whether good organization exists to work on this issue.

13. What are the ecological consequences of this action?

Research and experience in other states shows that the ecological consequences are positive. What might these consequences be?

VI. Recommendations: (FOR POP CANS)

It appears as though the pop can exists as a serious environmental issue. Environmental action is certainly appropriate. Action should be initiated.

The Final Step (VI-9)

Back in Module V you identified and investigated an environmental problem which interested you. After completing Module VI you have an opportunity to carry your interest one step further.

Carefully analyze your research findings from Module V and, to these, apply the action skills from Module VI in order to plan a campaign of action to help solve the problem. Your assignment here is NOT to take action because this is something YOU would have to do AS A CITIZEN. Whether you take action will depend on your values and whether your work in these modules has persuaded you that you should become involved.

Are you persuaded to work for a better environment? The final decision is your's to make!!

One Group's Decision

In the early 1970's a group of students in a course similar to the one you are in became very concerned because housing developers were filling in marine estuaries in order to get space to build houses. Estuaries are shallow, marshy areas where fresh water streams flow into and mix with ocean water. They are ecologically important because of the great amount of food and habitat they provide for young fishes and other marine animals.

The students formed an organization called P.Y.O. (Protect Your Environment) and used all of the skills discussed in this module to investigate the problem, select actions, and carry out a successful environmental action program to help solve the problem. They not only succeeded in saving the estuary, they were able to get a law passed which guaranteed that other such ecosystems on the east coast would be protected.

TEACHER'S EDITION

Investigation and Action Skills for Environmental Problem Solving

MODULES I - VI

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STIPES PUBLISHING COMPANY
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Published by
STIPES PUBLISHING COMPANY
10 - 12 Chester Street
Champaign, Illinois 61820

TEACHERS' EDITION

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What Is Environmental Education?

Environmental Education: That part of man's education that deals with the culturally-imposed, ecologically-related problems in man's environment . . . further, the acquisition and application of human values as related to the cultural use and misuse of both living and nonliving resources.

Introductory Information

The INVESTIGATION AND ACTION SKILLS FOR ENVIRONMENTAL PROBLEM SOLVING MODULES have been developed to accomplish a dual purpose. First, they are designed to prepare middle and junior high school students to investigate environmental problems in an autonomous manner. The first five modules afford the student an opportunity to become an independent researcher into environmental problem areas. These modules set the scene for research and make provisions for it.

However, the authors believe that research without subsequent environmental action is not enough to make an individual environmentally responsible. Hence a second purpose of these modules is to introduce students to the various modes of environmental action so that they might couple environmental problem awareness with activity which initiates constructive change. Module VI has been developed to present various action strategies and provides activities for both surrogate and real environmental action planning. The final and ultimate step - that of initiating and completing the planned action - is a decision left up to the instructor and his/her students.

These modules have been written as a consequence of the awareness of the authors that middle school students are ill-prepared to research environmental problems using primary and/or secondary sources of information or to take positive action. Early attempts to provide a learning climate in which normal middle school students could apply their own environmental interests to a research-oriented strategy failed, even under the direction of highly competent instructors. The students simply did not have the skills necessary for a successful interaction with environmental problems. This modular design has been developed to provide those skills so that students of varying abilities can become truly autonomous learners and careful action takers.

The actual training (skill development) portion of the INVESTIGATION AND ACTION SKILLS FOR ENVIRONMENTAL PROBLEM SOLVING MODULES (Modules I-IV and VI) takes approximately a few weeks longer than one semester to complete with students of junior high age - somewhat longer perhaps with younger students. However, this still leaves adequate time in the school year for in-depth research conducted by the student. It also allows for sufficient time to

engage in environmental action projects based on the autonomous research they have accomplished. It may occur that the class as a whole may choose a single group action project which they can plan and carry out. It is the hope of the authors that students will reach a point (after interacting with these modules) at which they desire and do take action based on the research they have done.

Grade Levels and Instruction Time

Investigation and Action Skills for Environmental Problem Solving has been successfully taught with students from sixth through tenth grade. The sophistication of the autonomous research projects accomplished by these students rests in the maturity level and skill competence at a particular grade level. All modules can also be used with gifted populations at intermediate elementary school grades. Care has been taken to maintain a reading level commensurate with students of these grades or abilities.

Many variables impinge on teaching the modules just as on any other instructional strategy. However, an instructor should plan on a minimum of one semester (18 weeks) of instruction for Modules I-IV and VI considering a five-day week and a time block of fifty minutes per day. The time needed for Module V varies greatly depending on the nature of the research conducted. Some students can effectively engage in autonomous research in less than six weeks--others require a much longer period of time. The time necessary to complete a planned action project will vary with the project chosen and the competence of the students.

Assumptions on Prerequisite Knowledge

A successful grasp of the materials presented in these modules is predicated on the assumption that the students have a foundation in the basic ecological principles which explain the operation of the biosphere. Knowledge of energy transfer, population dynamics, homeostatic balance, community and ecosystem interactions, etc. is essential to understanding the ecological basis of environmental problems and solutions. The authors of the modules have assumed that students will have much of this information. This assumption may be faulty in some instructional situations. Therefore, the following references are recommended for those instructors who feel that their students need ecological foundations before they engage in the materials presented here.

Materials on Ecological Foundations

Title	Supplier
Interaction of Man and the Biosphere by Norman Abraham et al. (textbook)	Rand McNally and Company P.O. Box 7600 Chicago, Illinois 60680
Understanding Ecology by Audrey Tomera (work-text)	J. Weston Walch, Publisher 919 Congress Street Portland, Maine 04104

Ecology: The Circle of Life by Harold R. Hungerford (trade book)	Childrens Press, Inc. 1224 W. Van Buren St. Chicago, Illinois 60604
Ecology: Interrelationships In Nature by Harold R. Hungerford and Audrey N. Tomera (8 sound filmstrips)	Society for Visual Education, Inc. 1345 Diversey Parkway Chicago, Illinois 60614

Comments on Instruction, Processes, and Evaluation

Like so many teaching strategies, the success of this modular design depends to a large extent on the teacher. As with any learning experience, the student becomes more proficient under a dynamic, empathetic, and cognitively demanding instructor. The processes under development in these modules, then, will be developed no further than is consistent with the demands placed on the students by the instructor. Even though performance objectives are specific for these modules, the successful acquisition of the processes involved usually lies somewhere along a continuum ranging from marginal success to outstanding criterion performance. It is up to the teacher to guide the students as close to criterion performance as possible. Less than this will be seen reflected in the students' ability to subsequently do research, i.e., cope effectively with Module V and actions projects chosen after interaction with Module VI.

The processes under development in these modules are definitely not restricted to science per se. They include investigation processes of science but also many of those normally associated with the social studies and language arts, e.g., written communication, identifying and clarifying values, letter writing, writing summaries, library reference skills, conducting surveys, collecting opinionaire data, and using questionnaires. The action modes discussed in Module VI carry on the integration of subject matter in a relevant societal context, e.g., analyzing written communication, identifying and clarifying values, proceeding with due political process, conducting product environmental impact and evaluating the ethics of action methods.

The interdisciplinary nature of the processes impinging on environmental education makes a logical case for an interdisciplinary teaching approach to this area. Where a school is departmentalized, cooperative planning and implementation of this modular strategy by the teachers of English, social studies, and science is recommended. However, if necessary, either the well-trained social studies or science teacher can handle it alone. The modules can also be effectively taught by a generalist in a self-contained classroom setting.

Every effort has been made to produce a modular strategy that incorporates a hierarchy of process development. The entire program begins with instruction in communication and ends in independent research and action planning which demands the application of a number of related skills by the student. Further, at each step of the way, a product is produced by the student to enable the instructor to evaluate progress. No formal tests are used in any of the

modules. However, performance objectives are specified for each of these modules and presented to the student. Since evaluation is implicit in the training sequences of Modules I-IV and VI, performance in terms of the objectives appears to be a most noted means of evaluation. Quite naturally, the ultimate evaluation lies in the products produced by students during autonomous research (Module V) and overt action behavior (Module VI).

Notes on Values and Value Clarification

By virtue of the subject matter of Module I and Module VI, the instructor must become well-versed in language arts techniques, economics and political science content of the social studies and ecologically related science topics. These modules contain the essence of environmental education--an interdisciplinary approach. Perhaps the most important teaching skill to be used with these modules is use of value clarification techniques. In most activities conclusions and answers are not cut and dried. Students should be encouraged to analyze issues, weigh actions, and estimate environmental costs. The instructor's task is to challenge the student's thinking, query the correctness of the content base which the students use in choosing alternatives and, above all, allow for and prompt the exposure of as many value constructs as exist within the classroom and/or world concerning issues and actions. Emphasis on value clarification is sound. Research indicates that didactic teaching of values to be ineffective. Modeling values can be another sound teaching tactic. However, students see so many conflicting values being modeled that no guarantee exists that "appropriate" values will be adopted. Values clarification seems to be the best alternative for dealing with values in education at this point in time.

By all means, share your values with your students. But share them as being but one way to view a situation--not dogmatic. An open atmosphere of free, respectful exchange between students and between students and teacher will increase the value of the activities in the modules. The skills approached are similar, if not the same, as investigation and action skills needed in many everyday life experiences. The modules also encourage the transfer of investigation and action skills to many phases of decision-making. Transfer is a much cherished goal of education and to this end these modules are dedicated. Students and adults live in a world where they should make decisions and take actions based upon sound logic and information. As instructors, it is our responsibility to begin to give children the opportunity to learn how to do this.

The following definitions are presented here to aid the instructor in regard to attitudes, values and human behavior:

Attitude: A person's favorable or unfavorable expression toward a class of objects or events.

Environmental Problem Issue: A particular interaction between man and his surroundings about which there are differing opinions or human values.

Value: A guiding force that determine the choices people make in living their life; a cluster of attitudes which generates either an action or a

decision to deliberately avoid an action.

Value Change: A process through which new value positions replace old value positions held by an individual.

Value Clarification: A process through which an individual's attitudes, beliefs, and/or values become clearer and meaningful to him or her.

For in depth discussions of values and value clarification techniques, the teacher is referred to the following sources:

Harmin, M., Kirshenbaum, H. and Simon, S. Clarifying Values Through Subject Matter. Minneapolis, Minnesota: Winston Press, 1973.

Kniker, Charles R. You and Values Education. Columbus, Ohio: Charles E. Merrill Publishing Company, 1977.

Raths, L., Harmin, M., and Simon, S. Values and Teaching. Columbus, Ohio: Charles E. Merrill Books, Inc., 1966.

Simon, S., Hower, L., and Kirschenbaum, H. Values Clarification: A Handbook of Practical Strategies for Teachers and Students. New York: Hart Publishing Company, 1972.

Knapp, Clifford. "Attitudes and Values in Environmental Education." The Journal of Environmental Education 3 (Summer, 1972), 26-29.

A Note on Instruction and Sequencing

The authors have used a particular teaching technique in developing the student materials of Modules I-IV. As each topic or behavior is introduced to the students, it is first identified, defined or operationalized for the reader. Next, the skill or behavior is then modeled for the students using the proper format or guidelines identified in the first step. In the final stage, the student is given an exercise in which he can apply both the definition and model in an actual situation. This format of skill identification, a model and an application situation is felt to be a firm foundation for learning. If at any time, the instructor feels that further application situations are necessary, he should not hesitate to provide them for the students.

As stated earlier, the modules have been developed to incorporate a hierarchy of process development. This hierarchy necessitates close attention to the sequence in which the modules are taught. The authors recommend that students be exposed to the modules in the sequence in which they are written. Module V, autonomous research, requires students to reach criterion performance on the skills presented in previous modules. Module VI should be approached after the students have done their research. It appears to be pedagogically sound to initiate an introduction to action and action planning after students are proficient in identifying and researching environmental problems. They can then apply their expertise to environmental action and can more

clearly see the relevance of the materials presented in Module VI.

Although careful sequencing of materials should be followed, it will sometimes be the case that a particular group of students will already be proficient in some of the skills covered in Modules I-IV. It is recommended that the instructor assess his students to ascertain this proficiency and then move on to more relevant module materials rather than belabor unnecessary material.

Research Results of Initial Trial Teaching

The 1972-73 school year saw the modules used for the first time. Further, the modules were only about 60 percent complete when students were first introduced to them. There was considerable question as to whether the modules should be used or whether they could even be marginally effective if used in part. The decision was made to "go ahead" and the modules were trial tested with 125 heterogeneously grouped eighth graders. The developers were not at all displeased with the results of the training aspect of the trial teaching and decided to pre-post the students concerning their values before and after autonomous investigation. A simple phenomenological evaluation was used and the critical question was the following: "What do you feel you should do as a citizen regarding this particular problem (the one chosen for autonomous investigation)?"

Subsequent to post-testing, students' pre- and post-responses were compared. Responses were evaluated in terms of how many value positions were stated or inferred in their responses as well as whether shifts in values took place. It was found that values did, indeed, shift in many instances. The directionality of shifts in value positions was not statistically analyzed because any evaluation of the degree of "goodness" or "badness" of students' values would be, in effect, an imposition of the writers' own values on the stated or inferred value positions of students. Even so, the writers were, for the large part, pleased with what they observed.

In 1975, a second research study was conducted by R. Henry Bisaga of Carbondale, Illinois. This study empirically examined the question of whether fifth and eighth grade students' values would shift as a function of the modules. Students were pre-tested immediately after deciding on the topic they would investigate in Module V. They were post-tested upon the completion of their research.

The fifth and eighth graders' responses to the evaluation were similar and therefore, the data was collapsed. Pretest responses were statistically compared to post-test responses. The following represent the questions and the statistical results:

(1) Question: What do you feel you should do as a citizen regarding this problem?

Comparison of responses pre- to post-:
Chi Square value for difference (x^2) = 15.62
Level of significance .001
N = 40

(2) Question: Do you actually believe you will do something about this problem? If so, what do you intend to do?

Comparison of responses pre- to post-:
Chi Square value for difference (x^2) = 21.02
Level of significance .001
N = 40

These results indicate that students' verbalized values do, indeed, shift as a function of autonomous research on an environmental problem of their choosing particularly with respect to environmental action.

A third research project is presently underway. It's purpose is to measure the effect of instruction in investigation and action skills on the overt action of junior high school students. Students' knowledge of investigation and action skills as well as their attitudes toward environmental problems are also being investigated. Since this is a longitudinal study, data are not yet available. It is hoped, however, that this study will shed light on the effectiveness of the modules in preparing environmentally active young citizens.

OBJECTIVES FOR MODULE I

Module I - Looking Into Environmental Problems

In Module I students are introduced to basic communication skills before dealing with environmental problems. Students then define "environment" and environmental interactions. With this basis in hand, they turn to a definition and identification of environmental problems. Subsequent experience is given in identifying the differing value positions which are inherent in specific environmental problems. Students gain experience in classifying environmental problems. Finally, students are presented with environmental anecdotes for which they identify and formulate problem questions.

Specific Objectives: As a function of Module I the student will be expected to be able to . . .

I-1. . . . identify himself as a discrete human being in a manner that separate himself from all other human beings using his name or any other nonphysical characteristics.

I-2. . . . prepare a written description of a human being known to him in a manner that would allow someone who was unfamiliar with that person to identify said person.

I-3. . . . successfully prepare a set of written instructions giving directions on how to proceed from Point A to Point B using a map.

I-4. . . . write an explanation of the student's interpretation of the term environment.

I-5. . . . list six separate interactions that take place in the environment between objects and/or events.

I-6. . . . prepare a list of ten distinct items that the student perceives as environmental problems.

I-7. . . . restate five of the problems listed in I-6 in question form.

I-8. . . . choose two of the problems stated as questions in I-7 and explain why these should be considered as environmental problems.

I-9. . . . express in written form, two divergent value positions concerning each item in a set of classroom situations where differing student values are prevalent.

I-10 . . . express, in written form, two divergent value positions for each item in a set of at least six environmental problems chosen by the student.

I-11 . . . using information gathered up to this point in the Moiule, define, in written form, the term environmental problem.

I-12 . . . using information given concerning the scientific skill of
I-13 classification, accurately group 20 environmental problems (of the students' own choosing) into each of four categories namely: (1) within the school; (2) within the community; (3) within the student's geographic region, and (4) problems of national or international importance.

I-14 . . . logically defend the classification of specific environmental problems categorized under the four headings noted above.

I-15 . . . using information concerning modes of investigating environmental problems, reclassify the original twenty problems stated in I-13 in terms of whether the student could study these problems: (1) via a first-hand investigation; (2) using secondary sources only, (3) using both secondary sources and first-hand investigations.

I-16 . . . subsequent to reading a description of an environmental problem, correctly identify problem questions that apply to that situation from a list presented to the student.

I-17 . . . subsequent to reading a description of an environmental problem, write problem questions that are totally consistent with the situation as described.

Suggestion for Teaching Module I

Research tells us that students learn, for the most part, what they perceive we want them to learn. This very observation tends to reaffirm one of the main benefits of the behavioral teaching model. Module I (and subsequent modules) incorporates a set of performance objectives for students. It is strongly recommended that the teacher go over these objectives with the students prior to the initiation of the unit plus the major objectives of all units - the development of a skilled autonomous learner. This major objective should be communicated in a manner that is intended to generate a feeling of worth and ability on the part of the student. This strategy reflects positive reinforcement, one of the most important tools available to an instructor at any grade level.

Communication activities, I-1, I-2, I-3, (pages 4, 5, and 6-SM). Students have been observing and communicating all of their lives. It is not anticipated that three simple exercises will develop a highly talented observer or communicator of data. However, these three activities are good warmup strategies for Module I and they also permit the teacher to stress the importance of critical observation and communication in the area of environmental problem solving.

Many students thoroughly enjoy I-2. It can easily become something of a contest to see who can first identify the person in the description. This exercise is most useful if the parameters established in the directions are followed carefully. Further, should the instructor desire, he/she can point out that the listener is using the skill of inferring (explaining an observation) when trying to identify the person in question from the description. This strategy might help all students see the value in making sure that their observations are correct and that they have been communicated clearly.

Defining "environment", I-4, I-5, (pages 8, 9-SM). The classic definition of this term normally incorporates all variables in the surroundings that influence a living organism. The task assigned to students in I-4 largely infers that they are to deal with the factors in their environments. This is, undoubtedly, a good place to begin. It is, of course, an extremely narrow treatment of "environment". One of the basic intents of this sequence of activities is to bring the student to a realization that "environment" goes far beyond those factors that influence the student directly. The writers would prefer to have the students gain a concept of environment that goes even beyond those influences that impinge on living things per se. The rationale here is that all abiotic objects also have "environments". Further, interactions can take place between abiotic conditions that do not directly influence living things. An example would be the interaction between crustal pressures and movements of rocks in the earth's crust. Another would be those reactions that take place between the atmosphere and sulfur compounds (given that no subsequent biotic influences occurred). A comprehensive concept of the term "environment" appears to have implications for further work in dealing with environmental problems and, therefore, it should be taken beyond the realm of the individual and living things per se. Of course, any reference to environmental factors outside the

realm of the individual himself must be thought of as actually being a part of the student's own environment - even though they may not influence the student directly.

The final task in this sequence is to have the students prepare a definition on which all can agree - a definition of "environment" that can serve as a model throughout the entire program. An example might be: Environment: Environment is made up of all objects and events in the universe plus all of the interactions taking place between those objects and/or events.

Writing lists of environmental problems, I-6, I-7. In I-6, (page 10-SM), the student is asked to list several problems in the environment. Although ten (10) are not required, it is reasonable to expect most students to come up with the criterion number. Although the student should not be expected to state these problems as questions, the examples associated with the exercises are so stated. Regardless of the mode of behavior expressed in I-6, it is strongly recommended that the teacher take this opportunity to make the point that environmental problems usually have no one right or wrong answer - that they are environmental problems because all people do not perceive them the same way. This becomes the primary defense for asking students to pose environmental problems as questions which is exactly what is asked for in I-7. I-7, (page 20-SM), however, can be deleted in the sequence if students have already grasped the idea of posing problems in a question format.

Photo Essay (pages 12-19-SM). The photographs used in this section not only represent actual environmental problems but can serve as an additional activity or activities for classroom use. In almost every situation for probing, questions are asked in the captions. The answers to many of these questions will necessitate further student research in order to obtain answers. Almost all captions supply excellent discussion topics. Do not feel limited to using only the questions presented. Students will probably generate others as the essay items are discussed. A beneficial extension of the photo essay would be to supply (or have students supply) other visuals collected from magazines, newspapers, etc. for further discussion. Perhaps a photo file and bulletin board could be established in the classroom as an ongoing reservoir of reference materials. Two good sources with which to begin such a collection follow:

> Phoenix Quarterly, a free publication published every three months by the Institute of Scrap Iron and Steel, Inc., 1627 K Street, N.W., Washington, D.C. 20006.
>
> Man As An Ecological Factor, a set of 18 black and white 11" X 14" posters with commentary available at a cost of $6.00 from J. Weston Walch, Publisher, Box 658, Portland, Maine 04104.

Defending statements of environmental problems, I-8, (page 20-SM). In I-8, students are asked to restate two problems and logically explain why they are problems. This gives them an opportunity to test their own abilities to adequately explain why a certain problem is, indeed, a problem. Some students will identify a problem but find it difficult to express themselves as to why it is, in fact, an environmental problem. Some patience should be tendered the students at this time but it is similarly crucial to make them understand that simply identifying a problem is not enough - that they must

also be able to communicate the reasons why it exists as a problem.

If students are observed to be highly frustrated with this activity it is suggested that the instructor discuss one or two environmental problems with the students, bringing out those factors that do, in fact, make them problems. These can then be put on the chalkboard as models for the students to refer to. Further, the instructor might decide to assign two or three additional problems for the students to do as homework assignments. The student should, of course, identify his own environmental problems if this procedure is followed.

Identifying value positions in classroom situations, I-9, (page 22-SM). This may well be one of the more crucial and difficult tasks in Module I. It is crucial because it is very necessary for students to begin perceiving what a human value is. It may be difficult because many students will be of the opinion that a value position is either totally right or wrong. It is important to make certain that students do not leave this exercise with the opinion that value positions are either right or wrong. The correct concept for students to have is that differing values may exist concerning an issue and that because of this, environmental problems exist. Further, it is important to help students conceptualize that values can often be expressed along a continuum from one extreme position to another extreme position. Making the analogy to politics might be useful in accomplishing this. However, leaving it with politics may not accomplish the desired end in terms of the environment - or the classroom situations described in I-9.

Identifying values for environmental problems, I-10, (page 24-SM). This exercise is basically the same as I-9 except that it puts the task in the dimension of environmental problems. Further, it permits the student to identify the problems in which the strategy will be conducted.

An interesting activity for the teacher to engage in with his/her students is to generate a worksheet similar to I-10 except identifying specific environmental problems in the center column. These can be distributed to the students to be completed as seat work or homework. It is imperative to point out to the students that they should seldom use words like "yes", "no", and "maybe" in assigning value positions on the worksheet. Upon the completion of the assignment, the instructor can ask students to communicate the value positions identified and compare their's to others communicated concerning the same problem. This could help reinforce the concept that there can be a variety of value positions regarding certain environmental issues. Some examples or possible entries to use on such a worksheet follow:

Strip mine coal?	Auto exhausts?
Roads through parks?	Wild rivers?
Worldwide use of DDT?	Water lawns and gardens?
Tax dollars for wildlife research?	Bird houses for song birds?
Smoking in public buildings?	Pet cats?
More national parks?	Street litter?

Definition of "environmental problem", I-11, (page 25-SM). As the student approaches I-11, he should be beginning to get the idea as to the meaning of the term "environmental problem". By no means is the definition of this

term an easy task. Still, it seems important to make the student come to grips with a workable and correct definition at this point in time. Since environmental problems are, by their very nature, culturally oriented, man enters the picture. Further, we have already identified that human values play a significant role in environmental problem situations. Therefore, the eventual definition produced by the class working cooperatively might be stated something as follows: Environmental problem: A particular interaction between man and his environment about which there are differing opinions or human values.

Classifying and defending classification schemes for environmental problems, I-12, (page 26-SM), I-13, (page 27-SM), I-14, (page 29-SM), I-15, (page 31-SM). Classification is man's way of organizing information into useful cognitive packets. It is arbitrary and, although this process follows particular rules for particular subject matter, it is simply a means for grouping objects and/or events having similar properties. In these modular exercises, students are asked to classify environmental problems two ways and defend one of them. First, problems are classified as to whether they are school problems, community problems, regional problems, or problems of national or international importance. This classification scheme is defended by the student. The rationale for this task is simple. Students who are not sophisticated in thinking about problems in the environment will likely perceive that they are all similar in many dimensions. Similarly, it is possible that they may feel that the environmental problems around them are strictly "someone else's business" and none of their own. Or conversely, they may perceive only local problems and fail to intellectually acknowledge problems at a national or international level. This exercise aids in expanding this conceptualization. Similary it shows a classification scheme at work and demands that the student defend the constructs used.

For immediate purposes, the classification according to whether problems can be studied by primary or secondary sources may be more pragmatic. This classification is prerequisite to tasks that will be accomplished in Module II. Although the student is not forced to defend this particular classification scheme, it is highly recommended that the instructor pay close attention to how the student classifies his/her problems and ask for a defense if there is any question about achievement on the task.

Analyzing questions about a historic environmental problem, I-16, (page 36-SM). If a human being perceives an environmental problem situation and cannot critically diagnose that problem in terms of the questions that need to be asked, his potential capability is reduced markedly. I-16 is a synthesis - comprehension type task and demands both critical reading and critical thought. The student is asked to read a passage concerning deer management in Pennsylvania early in the 20th Century and then respond to a list of six questions in terms of whether they logically fit the narrative.

The list of six questions to which the student responds is not a trite one. The questions are pertinent questions in dealing with wildlife management. Each of the six is actually related to the historical narrative and all should receive an "X" by the student. It is doubtful that many students will find this a simple task, but, for those who do, the instructor may wish to ask them to return to the narrative and attempt to identify other questions

having bearing on the passage.

Writing pertinent questions for an environmental problem situation, I-17, (page 37-SM). If the student is to become an autonomous learner he must be able to do more than indicate whether a particular question fits a particular environmental problem situation, i.e., I-16. In this process hierarchy, the appropriate final task is to ask the student to read a new problem situation and identify and write those questions pertaining to it. The narrative for I-17 deals with an alligator hunting season in Louisiana. At the end, the student finds a worksheet on which he will state the questions he feels are appropriate. One example has already been given to the student as a model.

Several appropriate questions are available from this passage. Among them are:

1. Should any animal that is considered an endangered species be hunted anywhere in the United States (or the world)?

2. What is the influence on public opinion when an animal is placed on the endangered species list?

3. Should the alligator be removed from the list of endangered species?

4. How can the population of alligators in the United States be suitably increased within its occupied range?

5. What is the effect of the alligator hunting season on poaching and the illegal traffic of alligator hides?

If the instructor finds that students are having a difficult time writing questions for the passage in question he should make out a worksheet similar to that for I-16 using the five questions noted above. This worksheet could then be distributed to students and acted on in a manner similar to the instructions for I-16. (If done, however, it is recommended that the instructor add two or three incorrect questions to the list.) Following this, the instructor should do I-17 using an entirely different narrative, one of his own choosing. Other possible topics for a narrative of this type are: Lake Erie, the American bison (buffalo), the Aswan Dam (Egypt), Great Plains Dustbowl, the passenger pigeon, and the super-sonic transport (SST). Every effort should be made to bring students to criterion on this task.

Comments on environmental problems, Modules I and V. For many who are inexperienced in perceiving environmental problems, the topics in Module I and V will be most difficult. Students and instructors alike may run out of ideas for problem topics. It is recommended that the instructor thoroughly examine all the modules in a search for problem topics. The authors have used many such topics as exercise material throughout. Many of these topics can be suggested to the student as potential subjects for autonomous research. For example, the photo essay on pages 12-19-SM identify such subjects as waste disposal, aesthetic pollution, channelization, damming, strip mining, urban sprawl and superhighway construction. Each of these,

in more specific form, would serve as viable topics for autonomous student research or for instructor expansion as ancillary material. The authors listed in the teachers' manual for Module II are an excellent source of further environmental material as are the bibliographic entries on pages 58-60 in the student manual.

OBJECTIVES FOR MODULE II

Module II - Using Secondary Sources In Studying Environmental Problems

In Module II students are introduced to periodicals, agencies, and examples of community resource people which are valuable in obtaining information concerning environmental problems. Similarly, students compare secondary sources to identify how they may differ from each other, identify governmental or private agencies to which they can write for information, identify and communicate two or more value positions expressed by environmental news articles, write a succinct summary of an environmentally related article, and locate three valid references for an environmental problem of their choosing. Further, they are introduced to the skills needed for the successful use of the library, i.e., the cards of the card catalog, The Readers' Guide, the Dewey Decimal System, and cross indexing. Finally, students are presented with a written research report which serves as a model and are asked to analyze that report.

Specific Objectives: As a function of Module II the students will be expected to be able to . . .

II-1. . . . compare two separate information sources concerning coal reserves and identify the important data (information, values, value positions) in each source and communicate how these data differ.

II-2. . . . identify governmental or private agencies to whom he can write for specific information concerning an environmental problem.

II-3. . . . write a sample letter to an agency requesting information about a particular environmental problem. The letter is to be accurate in terms of its general structure, the agency chosen to be contacted, and the specificity of the information requested.

II-4. . . . read two separate environmental news articles and state specifically at least two differing value positions as expressed in each article.

II-5. . . . locate and read one environmentally related article approved by his instructor and subsequently write a succinct summary which accurately communicates the main point(s) presented.

II-6. . . . choose a specific environmental problem, locate three valid references concerning this problem, and correctly list these in written form.

II-7. . . . successfully identify the written information (and symbols) used on a card from the card catalog.

II-8. . . . successfully identify the written information (and symbols) used in a reference from The Readers' Guide.

II-9. . . . analyze a research report dealing with polar bear management and . . .

A. cite one accurate source of information to which the author might have written for more information.

B. explain why the author was unable to answer one of the questions posed in the report.

C. determine if the author's values toward polar bear management are reflected in the report and, if they are stated or inferred, identify where this information is located.

D. state specifically, at least two reasons, why the reader considers (or does not consider) the research report to be a good, thorough job of covering the subject.

Suggestions for Teaching Module II

Module II introduces the student to an array of strategies he will find extremely useful in researching environmental problems using secondary sources. Locating, analyzing, and using information sources are the key elements in this module. At first glance, most of the objectives deal rather specifically with language arts skills. Even though this module emphasizes language arts skills, these processes are totally developed around environmental topics. Thus, one of the more prominent challenges of education is met squarely in this module - the integration of content. Aside from this highly desirable aspect of Module II, students are again exposed to a wide array of environmental problems, ranging from energy production to polar bear management. A good deal of conceptual content is subtly infused into the module making it attractive for teaching environmental education.

Initially, Module II presents the student with considerable information dealing with periodicals, newsletters, organizations involved with the environment, and examples of resource personnel who might be available to the student should the student choose to search them out.

The first exercise, II-1, (page 46-SM), focuses on getting the student to realize that he must approach references dealing with environmental issues cautiously. The fact that many references deal with very specific environmental biases makes this activity extremely important for the student. Just what should a person believe? What biases are present? Why is the author biased in the manner reflected in the article, pamphlet or whatever? How can a person check the validity of the information given? These are all points to consider in dealing with the information and tasks associated with II-1.

Correct responses are given to the student upon completion of the first two sections of II-1. The third task merely asks the student to compare a new reference with the initial reference. Data presented can be checked against data given the student in the module. More importantly, the teacher should stress how different the two sources are and possible reasons for these differences.

Exercise II-2, (page 50-SM), involves the students in a short but important task of determining where to write for information concerning timber harvests in national forests and values operating which keep the world's population from reaching zero. This written activity, although important, is probably far less important than the rules expressed for letter writing activities. In any event, appropriate responses for the first part of II-2 include The American Forestry Assn. and the U. S. Forest Service. Responses for the second task include Planned Parenthood and Zero Population Growth.

It seems imperative to reinforce the rules stated in this module concerning the writing of letters for information. Summarized, they may be listed as follows:

1. Choose an appropriate source to which to write.
2. Be very specific in the request for information.

Of course, form, grammar, and punctuation are of importance. Exercise II-3, (page 53-SM), gives the instructor an opportunity to evaluate practice letters written by students. It is highly recommended that the teacher be rigorous in his/her evaluation of these practice letters. A poor model at this time in no way guarantees good letter-writing skills when applied in a real situation. You may find that your students will require specific instruction in letter writing. Do not hesitate to do so or to team up with the language arts teacher in order to accomplish this.

Although no activity is suggested for the section on interviewing local resource people, feel free to create your own. The students might be assigned a specific topic and instructed to name two or three pertinent resource people. A role-playing situation between interviewer and interviewee would also seem an appropriate extension. The class might then critique the session in terms of appropriate interview procedures. Telephone protocal might be another discussion-activity topic.

Exercise II-4, (page 55-SM), once again, takes a look at values in relation to printed information. In the examples used, alternate value positions are stated or inferred. Students are asked to identify these value positions in two separate news articles. This activity not only reinforces the students' perspectives of values, it also helps get them ready to begin reading and summarizing articles concerning environmental problems. And, it is often critically important for a summary to capture accurately the value position(s) of the writer(s). Further, it is hoped that the student has begun to perceive the necessity for reading critically, particularly in the context of bias or values. This activity bears repeating if you have available divergent articles on the same issues. Perhaps there is a local or state environmental issue occurring in your area which is being covered in the local papers.

Exercise II-5, (page 60-SM), has the student write a summary of an article approved by the instructor. This task is simply to give the student practice in summarizing a printed article and force him to take a hard look at his summary from several standpoints. It is somewhat questionable whether this one summarizing assignment will give the student expertise in this skill (or set of skills). The instructor may well decide to have students summarize an additional article after the initial effort has been evaluated. If this is the case, it is further suggested that the instructor find one or two succinct but excellent articles, reproduce them, and use these for this assignment. This will permit closer scrutiny of the product.

Library Research, II-6, (page 62-SM), finds the student searching for three references concerning a particular topic and putting them into a standard bibliographic format. Some educators would question putting this exercise here, before giving the students an introduction to library skills. However, the task is here for a reason. It is hoped that the student will experience at least a minimum of frustration in the completion of this assignment. Although not a strategy used often enough in the classroom, students learn much better when they perceive the need! Subsequent library skills should be developed better as a function of some frustration with II-6. However, the task in II-6 is an important one in its own right and should be seen to completion. It is further recommended that II-6 be **repeated** at the end of Module II as an evaluation of the extent to which students have acquired the library skills in II-7 & II-8.

The Card Catalog and II-7, (page 67-SM), this section introduces the students to the card catalog (the next section deals with The Readers' Guide). The three main types of cards found in the card catalog and the information found on these cards are introduced. Similarly, the Dewey Decimal System is outlined. II-7 calls for the student to recognize a title card, state where in the library this particular title will be found, and identify the specific information found on a title card. If the student achieves criterion on this task, one might feel comfortable about the student's perception of catalog cards.

A trip to the library and actual contact with the card catalog is crucial. Topics should be assigned students to look for after the card catalog is reviewed in the library itself. A few possible topics follow:

Subjects

air (air pollution)
Alaska
bison (buffalo)
coal mining
conservation
ecology
energy
mammals
national parks
noise (noise pollution)
nuclear (nuclear energy)
pesticides
population
prairie
river
swamps
waste (waste disposal)
water (water pollution)
wolf (wolves)

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If your school library is inadequate or non-existent, a field trip to the high school center or the public library is suggested.

The Readers' Guide, Cross Indexing, and II-8, (page 70-SM), The Readers' Guide is approached in much the same manner as the card catalog. It is explained and specific examples with their associated symbols are also explained. Cross indexing and its value are introduced. The section closes with II-8 which calls for the student to identify the information and symbols used on a specific reference from The Readers' Guide.

Again, it is strongly recommended that The Readers' Guide be studied in the library itself. It is a tremendously valuable tool in doing library research and the student who does not feel comfortable with it could wander aimlessly, accomplishing little.

It is further recommended that topics be given the students for practice in using The Readers' Guide. Similarly, the instructor may wish to evaluate the students in more detail than II-8. This should be considered appropriate, particularly if II-8 is completed before the students go to the library to investigate The Readers' Guide and/or if they did not achieve criterion on II-8.

The Polar Bear Model and II-9, (page 78-SM), this section presents a research report entitled "The Polar Bear: An Endangered Species." This research report is presented as one example of the kind of product made possible by using secondary sources. It can be used by the students also during Module V as a reference.

The topic of polar bears is one having considerable interest for middle school students so motivation for reading is little problem. However, II-9 asks some pointed questions about the report which may demand that the students go back and do some critical rereading. Appropriate responses for II-9 follow:

II-9-1. American Museum of Natural History
National Wildlife Association

II-9-2. The particular question referred to by the author cannot be answered simply because no one knows for sure at this time.

II-9-3. The author's values concerning polar bear management are largely inferred from the title and the first and last paragraphs of the report. (It is suggested that, during class discussion of this particular assignment, students attempt to interpret what the author's values are. Further, the instructor can theoretically place the author in fictional situations and ask the class how he would probably behave in those situations, e.g., the writer is invited to go to Labrador and hunt polar bears for their skins.)

II-9-4. There is no one right or wrong answer here as it depends upon the reader's perceptions concerning the quality of the work. However, it is important for the student to adequately defend his position whichever way he chooses to respond.

Again, the authors of this module suggest repeating II-6 at this time unless the students appear to have a thorough grasp of how to use the library. If repeated, students should probably research a topic different from that researched the first time II-6 was completed.

OBJECTIVES FOR MODULE III

Module III - Using Surveys, Questionnaires, and Opinionaires in Environmental Investigations

In Module III, students are introduced to the basic research strategies reflected in the title of the module. They identify several topics in environmental education that lend themselves to gathering data via surveys; they identify those rules which control the effectiveness of a survey, and evaluate a completed survey to determine whether the rules governing surveys have been respected. Students identify several topics that lend themselves to collecting data via questionnaires and write a list of rules governing questionnaires. Further, students identify topics that lend themselves to data gathering by opinionaires and subsequently identify, from a list of 10 research questions, those problems which are basically surveys, questionnaires, or opinionaires. And, finally, working closely with the instructor, teams of students choose to do surveys, collect data with a questionnaire, or gather data with an opinionaire and record the data collected.

Specific Objectives: As a function of Module III, students will be expected to be able to . . .

III-1. . . . cite several environmental issue topics which lend themselves to gathering information via surveys.

III-2. . . . identify those rules which tend to control the effectiveness of survey type strategies.

III-3. . . . evaluate a completed survey and determine whether the rules governing surveys have been respected.

III-4. . . . cite several environmental issue topics which lend themselves to gathering information via questionnaires (other than the ones listed in the module as examples).

III-5. . . . write a list of rules which tend to control the effectiveness of questionnaire type strategies.

III-6. . . . cite several environmental issue topics which lend themselves to gathering information via opinionaires (other than the ones listed in the module as examples).

III-7. . . . successfully identify, from a list of 10 research questions, those items which are basically surveys, questionnaires, or opinionaires.

III-8. . . . choose a research strategy using either a survey, a questionnaire, or an opinionaire, conduct the research and successfully communicate the data collected during that research.

Suggestions for Teaching Module III

Module III introduces the student to a variety of strategies he will find appropriate for data collection on a first-hand basis, (primary sources). The key elements of this module are: (1) designing surveys, questionnaires, and opinionaires that obtain data pertinent to a specific question and/or problem recognized by the investigator; (2) organizing, compiling, and recording data consistent with the survey, questionnaire, or opinionaire used.

The first portion of the module is limited to the application and rules governing good survey technique. Exercise III-1, (page 83-SM), focuses on getting the student to recognize the parameters of surveys and the kinds of questions and/or problems for which surveys can provide useful data. If the student does in fact, incorporate most of the major conditions critical to surveys in his responses on Exercise III-1, the instructor can infer that appropriate conceptualization has taken place. However, if the student does not incorporate most of the major conditions critical to surveys into his responses, the instructor should provide the student with additional time, help, and practice in writing correct responses. Students responses in Exercise III-1 can be measured against the "what" and "where" rules on page 84 in the student manual.

Exercise III-2, (page 84-SM), involves the student in a brief but important task of determining what constitutes a good survey. What is the exact nature of information to be collected? In what geographic area is the information to be collected? How is the data to be recorded and communicated? These are all questions that should be answered in the process of designing and conducting a survey. The correct responses students should give in Exercise III-2 are referred to in the paragraph in the middle of page 86 in Module III (all are answered "yes"). However, the students should not be referred specifically to that paragraph until they have completed Exercise III-2.

In Exercise III-3, (page 85-SM), the student is asked to apply the rules governing surveys to an actual survey conducted by eighth grade students in a small midwestern city. Subsequent to the application of a specific rule, the student is asked to write a defense for his answer based upon the context and data of the survey. The discussion following the activity provides the student and instructor with an opportunity to evaluate the students mastery of the essential rules governing the construction and implementation of a useful survey.

The second portion of Module III focuses on techniques of designing, and implementing questionnaires and opinionaires that will provide good, useful data. Exercise III-4, (page 89-SM), focuses on getting the student to recognize the parameters of questionnaires and the kinds of questions and/or problems for which questionnaires can provide useful data. The discussion following Exercise III-4 points out a distinct difference in the purpose of opinionaires and questionnaires. It seems appropriate to point out that questionnaires are designed to collect hard, cold facts or data, whereas, opinionaires are designed to determine what are people's thoughts about a

specific topic at a specific time or what their feelings are on a specific question and/or subject. An excellent teacher reference on questionnaires is: Questionnaires: Design and Use by Douglas R. Berdie and John F. Anderson, available from The Scarecrow Press, Inc., Metuchun, New Jersey 08840.

In Exercise III-5, (page 88-SM), the student is asked to use the basic list of rules for conducting a survey as a reference and, from those, develop a list of rules that should control the quality of a questionnaire. It is imperative for the teacher to reinforce the rules governing the quality of surveys, questionnaires, and opinionaires. The rules for each are as follows:

Rules Governing Surveys, Questionnaires, and Opinionaires

S = Survey Q = Questionnaire O = Opinionaire X = Applies to

S	Q	O	Rules
X	X	X	1. Carefully decide the exact information (data) to be collected.
X	X	X	2. Specify the exact geographic area in which the data are to be collected.
	X	X	3. Specify the exact population from which the data are to be collected.
		X	4. Specify the exact opinions and/or beliefs about which the data are to be collected.
X	X	X	5. Collect enough data to make sure that the data are truly representative of the problem in question.
X	X	X	6. Record all data collected carefully and completely.
X	X	X	7. Work out a system that will accurately communicate the data to others, e.g. charts, graphs, tables, written discussion.
X	X	X	8. Make sure that all conclusions, inferences and recommendations are substantiated by the information collected. (see Module IV)

Exercise III-6, (page 90-SM), has the student write specific questions and/or problems for which an opinionaire can be used to collect data. The use of a question format is recommended. This task is simply to give the student practice in setting parameters for opinionaires that will insure the collection of meaningful data. Exercise III-6 will also help the student recognize the distinct differences between a questionnaire and an opinionaire. If the student incorporates the essential conditions critical to opinionaires in his responses on Exercise III-6, it is safe to infer that conceptualization of what constitutes a good opinionaire has taken place. However, if the students' responses indicate that conceptualization of what constitutes a good opinionaire has not taken place, the instructor should ask the student to use the basic list of rules for conducting a survey as a reference and, from those, develop a list of rules that should control the quality of an opinionaire. If necessary, the teacher should provide the student with additional time, help and practice in writing correct responses to Exercise III-6.

Exercise III-7, (page 92-SM), is a self-test designed to help the student determine whether or not he fully understands the parameters of and distinct differences between survey, questionnaires, and opinionaires. If a student responds correctly to all ten items on the self-test, the instructor can infer that the student has conceptualized the information presented in the previous exercises (.... or that the student is a good guesser!!). Students should be encouraged to correct any errors by applying the rules governing surveys, questionnaires, and opinionaires to the statement or problem in question.

In Exercise III-8, (page 93-SM), the students are to actually do a survey, questionnaire, or an opinionaire. The model survey to be used on pages 94-96 SM is structured to determine: (1) how many trees and shrubs exist in a given area; (2) where the trees are located; (3) what kind of trees and shrubs have been planted in the area.

This particular survey may not be usable in its present form for all school sites. Consequently, the instructor is encouraged to make modifications or select alternatives necessary to utilize the survey for a particular school or neighborhood setting.

The questionnaire and opinionaire models should require little or no modification since they do not require the existence of specific physical surroundings.

There are many topics that can be investigated by using surveys, questionnaires, and opinionaires. Many of the topics identified in Modules I and II are amenable to these techniques. You may want your class to investigate one of them. However, it is suggested that the first time you use this technique, keep it relatively simple and help the students collect the best possible data.

When setting up the exercise, the instructor may want to consider the following suggestions:

(1) Arbitrarily divide the class into research teams. It is preferrable not to assign more than 4 students to a team.

(2) The instructor may choose to allow each team to decide whether they are going to do a survey, questionnaire, or opinionaire. The instructor may, however, wish to arbitrarily assign a survey, questionnaire, or opinionaire to each team. It is imperative at this point to make sure that a survey, a questionnaire, and an opinionaire are being done within each class.

(3) Carry out the surveys, questionnaires, and opinionaires.

(4) Using data sheets, ask each team to share its findings with the rest of the class. This may be done in several ways: (1) short, informal oral reporting; (2) duplication of data sheets; (3) written discussion of the data. In any event class discussion and analysis should ensue.

The instructor should utilize the team reports to reinforce the rules governing good surveys, questionnaires, and opinionaires. Students should be encouraged to evaluate the reports in this dimension. Further, the instructor should stress the point that the skills learned in this module can be transferred to new situations demanding similar research skills.

OBJECTIVES FOR MODULE IV

Module IV - Interpreting Data in Environmental Investigations

In Module IV students are introduced to techniques of reporting and interpreting data. Students receive practice in identifying and writing conclusions, inferences and recommendations that are consistent with data collected. Similarly, students are asked to apply the critical rules of formulating conclusions, inferences, and recommendations by evaluating and rewriting the conclusions, inferences, and recommendations made by the investigators on a variety of research questions involving data collected from secondary resources and surveys.

Students are introduced to several techniques that may be used to report data. They are asked to write one conclusion and one inference that is consistent with one set of data presented descriptively and graphically. Finally, the students transfer one set of data to a line graph and write one conclusion, one inference, and one recommendation that is consistent with that data.

Specific Objectives: As a function of Module IV, students will be expected to be able to . . .

IV-1. . . . accurately identify appropriate conclusions written for a specific environmental observation.

IV-2. . . . write both conclusions and inferences appropriate for normal, everyday happenings.

IV-3. . . . write recommendations for a sample survey, those recommendations being based on the conclusions and inferences produced during that survey.

IV-4. . . . evaluate conclusions, inferences, and recommendations written as a part of a complex environmental study. Further, you will be expected to rewrite one inappropriate inference and one inappropriate recommendation found in this study.

IV-5. . . . (a) reread the polar bear research report in Module II and successfully evaluate that report in terms of its recommendations.
. . . (b) write one recommendation for the polar bear research report that could logically be put forth.

IV-6. . . . (a) report one conclusion and one inference that could be produced from one set of data that has been reported two different ways.
. . . (b) identify how the two sets of data noted above differ.

IV-7. . . . successfully transfer one set of data to a line graph.

IV-8. . . . evaluate the data graphed in IV-7 and write one conclusion, one inference, and recommendations based on that data.

Suggestions For Teaching Module IV

In Module IV the students are acquainted with techniques of reporting and interpreting data. In order for the data collected by an investigator to be meaningful, it must be communicated to other investigators and interested people. The investigator should report the data as simply as possible in a concise, logical, and orderly sequence. Furthermore, it is the investigators' responsibility to provide on the basis of the data, an interpretation of the data collected, e.g., drawing conclusions, making inferences and recommendations.

The writers have found that students understand the importance of clear, concise communication better if one basic rule is followed: all scientific writing should be completed in a manner in which someone completely unfamiliar with it can understand it.

Essential components of this module to be mastered are: (1) rules governing the reporting of data; (2) rules governing the formulation of conclusions, inferences, and recommendations; and (3) the application of these rules in a variety of environmental situations.

Exercises IV-1 and IV-2, (page 105 and 107-SM), focus on getting the student to recognize important parameters for drawing conclusions and making inferences. It is imperative at this point for students to conceptualize what constitutes a good conclusion and a good inference. In addition to the exercises in the student edition, it is suggested that the teacher present several scenes to the students, either orally or in writing, and ask the students to write one conclusion and one inference based upon the information presented. (Two such scenes are provided in the paragraphs following.) The students should be asked to defend their responses in accordance with the parameters established for writing good conclusions and inferences. Student defenses may be oral or in writing depending upon which teaching strategy is preferred.

During this exercise the teacher and students must keep firmly in mind that: (1) conclusions follow exactly the observations made; (2) a conclusion is the communication of an observable event, happening, and/or situation; (3) a conclusion in no way attempts to explain why something happened as it did; (4) a conclusion is simply an expression or statement of the end result; (5) an inference is the explanation of an observation; (6) an inference is an implication-an assumption or judgement made from the data (or from the conclusions).

Scene #I

A botanist visits a woods every ten years to study a population of wild, rare orchids. Each year he observes that the population gets smaller. The conditions in which the orchids are growing seem to change very little. Although he sees no people there on his trips, he does note increasing evidence of camping in the woods.

Possible Responses:

Conclusion: The orchid population decreases steadily.

Inference: Campers are probably digging up orchids and taking them home.

Scene #II

Waggonerville, a small town in Arizona with a population of about 5000 people, is located in a large canyon. Five years ago a copper refinery was built and began operating in Waggonerville. In the process of smelting the copper ore the refinery pours large quantities of smoke into the air. Since the town and refinery are located in a canyon the smoke is not readily dispersed by the wind.

While checking hospital records, a local doctor noticed that respiratory ailments had increased 250% during the five year period the refinery had been in operation.

Possible Responses:

Conclusion: Respiratory ailments have increased 250% since the refinery began operation.

Inference: There is a direct relationship between the refinery operation and respiratory ailments. (cause and effect)

(Student responses should be very similar to those given above.)

Exercise IV-3, (page 109-SM), focuses on the parameters necessary for making recommendations. A recommendation is a piece of advice given to a person or persons concerning some particular action or problem.

It is important in Exercise IV-3 that students realize that any recommendations they make as a consequence of their study must be completely consistent with the data collected. The teacher should not hesitate to ask students to defend recommendations they make either on the basis of data given in the exercises or data they collect in their own study.

Exercise IV-4A-4E, (page 110-115-SM), is structured around a study to determine whether or not bluebirds nesting in southern Illinois prefer nest boxes facing a particular direction when all are installed around a wooded area, 1.5 meters off the ground. (See student edition, pages 111-113).

In Exercises IV-4A to 4C, (pages 114-115-SM), the student is asked to apply the rules for drawing conclusions, making inferences, and recommendations by evaluating the conclusions, inferences, and recommendations presented in the study. If the student incorporates the important rules for drawing conclusions, making inferences, and recommendations in his defense of the responses he gives, the instructor can infer that appropriate conceptualization has occurred. The student and teacher can find the appropriate responses to the exercise on pages 115 and 116-SM.

In Exercise IV-4D and 4E, (page 117-SM), the student is asked to modify an inferior inference and recommendation. If the student successfully produces an inference and recommendation that obviously adheres to the rules governing the formulation of each and the data presented, the instructor can infer that conceptualization has taken place.

The bluebird study would be considered a survey rather than an experiment. Following are several reasons why the authors would categorize this study as a survey:

1. This kind of study is best described as a pilot study - one leading to information from which a sound hypothesis could be generated for rigorous experimentation.

2. The researcher observed bluebird behavior every two weeks for two nesting seasons - a typical survey strategy.

3. Too many assumptions were made in the study. Among them were that bluebird boxes operate best 1.5 meters above the ground and 30 meters apart. Another deals with habitat. Were all south-facing boxes in full sunlight or were some shaded a part of the day? A third is the assumption that all boxes should be installed facing a woodland habitat.

4. The size of the population was small. Only twenty-four bluebird boxes were erected. This resulted in only thirteen nests over a two-year period - hardly enough on which to base firm experimental conclusions and inferences.

Exercise IV-5A, (page 118-SM), refers the student back to the "Polar Bear" research in Module II. This strategy is not unintentional. It will allow the student to view a piece of research, from a different perspective than he did initially. In this exercise, the student is asked to read the research report critically and determine if the investigator did, in fact, make any recommendations for action as a consequence of his research findings. If the student responds correctly and utilizes the critical rules for making recommendations in the defense of his answer, it is an indication that conceptualization has occurred and the student can apply that concept to a new situation. (The correct response is indicated in the paragraph following Exercise IV-5A, page 118-SM).

Exercise IV-5B, (page 118-SM), asks the students' opinion as to whether or not a researcher should make recommendations on the basis of data collected from secondary sources. Hopefully, although it is not necessary, the student will respond positively toward the question and develop a rationale based upon the premise that recommendations consistent with the data collected provide other researchers and interested people with a course of action.

Exercise IV-5C, (page 119-SM), asks the student to write a recommendation based upon data about polar bears collected from secondary sources. Many students may have difficulty in making such a recommendation due to the limited information. During the class discussion of this activity, the teacher should point out, that when an investigator finds certain types of

information about a particular problem, question, and/or subject is not available, he can recommend that research in those areas be done. It should be pointed out to the student that he can recommend appropriate action to be taken until such information is made available. (see recommendation by authors, second paragraph, page 119-SM).

In Exercise IV-6, (page 122-SM), the student is asked to write one conclusion and one inference that is consistent with the same data presented two different ways. The focus of the exercise is to point out how the technique an investigator chooses to present his data effects his communication and interpretation of that data. Pros and cons of presenting data graphically and/or descriptively are presented in the paragraphs following the exercise. (See page 122-123-SM).

Possible Responses:

Conclusions that may be drawn from both sets of data are:

(1.) Browse production in a 5-year old hardwood forest may be 400 Kg per acre per year, whereas in a 35-year old forest browse production may be only 50 Kg per acre per year.

(2.) Younger hardwood forests produce more browse than older forests.

Inferences that may be drawn from both sets of data are:

(1.) A young hardwood forest will support a larger deer population than an old hardwood forest covering the same amount of area.

(2.) As trees grow taller, browse production in a hardwood forest decreases.

Exercises IV-7 and 8 (pages 123-125-SM), ask the student to plot graphically quantitative data concerning the Kaibab deer population and draw a conclusion on the basis of that data. Subsequently, new information is provided for the student whereupon he is asked to make an appropriate inference and write one appropriate recommendation.

A valid conclusion that may be formulated from the data would be:

The deer population of the Kaibab Plateau increased from 6,000 in 1907 to a maximum of 100,000 in 1923, then decreased steadily to 9000 in 1938.

An appropriate inference may be:

When natural enemies of the deer such as the coyote and mountain lion are killed off, the deer population initially increases.

Possible recommendations would be:

(1.) Laws prohibiting the killing of natural enemies to the deer, such as coyotes and mountain lions should be enacted and enforced.

(2.) Hunting of both does and bucks should be allowed in those areas where natural predators have been removed or severely reduced in population.

If in Exercise IV-8 the student can correctly state a conclusion, an inference, and a recommendation utilizing the critical rules governing each, it is an indication that appropriate conceptualization has taken place, and the student can apply the concepts to a new situation.

STUDYING AN ENVIRONMENTAL PROBLEM

-Its Your Move-

No performance objectives have been written for Module V. None need to be. Evaluation, in a sense, is a simple matter. How well can the students function in research on environmental problems in an autonomous manner? This may seem a cop out! If so, we would suggest that the research in which the student engages should serve as an evaluation of whether he has the skills and can apply those skills to a problem situation. It's not a matter of his choice of research strategies as much as it is whether he can apply the skills inherent in the research strategy chosen.

Some instructors may be quick to criticize the authors if the students have problems while engaged in autonomous research. The writers would like to point out very specifically that they have not guaranteed that the students would be able to function without guidance and input from the teacher. Neither do they guarantee that the student will be able to inductively transfer his skills from the training modules to the autonomous module. Indeed, it is hoped that he can but research points out clearly that transfer takes place most appropriately when it (transfer) is taught. In other words, it may well be appropriate for the instructor to help the student see how acquired skills can be applied to the new and unique situation in which the student finds himself.

The writers WILL GUARANTEE, however, that students who have successfully completed the first four modules WILL succeed in autonomous research far better than students without the modular training. This, of course, assumes that the instructor serves as consultant and "research associate" to the student. Certainly, the instructor need not engage personally in the research, but the student must feel that the instructor perceives the importance and excitement in the research being conducted. This is quite necessary because the instructor must approve the research question in the first place. If the research question is a poor one, it should never be accepted in the first place.

Time Estimates

Time estimates for Module V are very difficult to make since the student is not only in an individualized learning situation but also on a self-paced schedule (time and teacher permitting). Trial testing of Modules I, II, III, and V during 1972 indicated that students will choose a variety of problems on which to do research and that many variables impinge on the speed at which these can be successfully completed. Students must write away for information. Sources are not always prompt in replying. Students cannot always get instant interviews with governmental or other professional people. A needed book may be temporarily out. A trip to another library may be necessary. Producing valid questionnaires takes time. A horde of seemingly impeding problems seem to plague progress. This is a part of the

scene and the instructor should anticipate some frustration.

Some students may finish projects and have reports completed within three weeks. Others may take six to eight weeks to complete. A number of strategies can be used to "take up the slack". A student finishing early may be eager to tackle another problem, or, perhaps, take some sort of action based on the findings of his research. Both of these behaviors were noted during initial trial teaching. The teacher may choose to "bring the class together" one day per week, perhaps on a Wednesday, to permit an open discussion of progress and/or problems. Beginning the third week, the teacher may want to schedule research reports for those students having answered their chosen research questions. Of course, the instructor must not evaluate the student on how long it takes him to complete his project (unless, of course, the student's motivation to reach closure is low).

It is questionable whether to "force" a student to do an additional piece of research (given that the initial research was of a quality nature). However, one of the basic characteristics of science is that research normally breeds new questions needing answers. This can be pointed out to the student and the instructor might even go over the student's findings, inferences, and conclusions to help him identify new avenues to probe. One should not expect all students to be self-motivated in the area of environmental problems. This being the case, the instructor may be forced, eventually, to place certain students back into a highly structured learning environment. If this becomes necessary for certain individuals, the teacher should definitely not feel incompetent. It should be recalled that the student may only be influenced by the instructor five hours per week. Many other variables impinge on the student during the other 163.

The Learning Contract

Module V is planned to be structured around a contractual agreement with the students. A model contract is included with this Teachers' Edition, with reproduction privileges. Considerable thought has gone into the evaluation parameters and they should be carefully studied before being modified by the instructor.

All evaluation components, except one, directly or indirectly reflect skills developed in the modules. The one not referring to skills on which the student has had at least partial training is that dealing with his seriousness of approach to the investigation. The reader will note that this criterion has been given only a 10 point value. The contract itself is probably a better guarantee of performance than this criterion and if the instructor determines that it should be deleted this should not greatly affect student behavior (if the contract itself is used).

The teacher may be concerned as to why the research question is given only a 10 point value. This is simply because the instructor has already approved the research question and, if it is not worth criterion, the instructor has faulted in his responsibility to help guide the student toward a workable research strategy.

In terms of the class presentation evaluation component, it is the instructor's responsibility to identify the characteristics or parameters that students' should follow in their oral reports. These should be communicated to the students far in advance of the actual presentation. Some guidelines to consider are: clarity of presentation, completeness and accuracy of report communicated, use of audio visual aids, effectiveness of communication, etc. The intent of the oral presentation is to inform the entire class of the issue researched. It can serve as an additional learning activity for the entire class and could serve as a spring board for additional class discussion. Such reports can also serve as topical material for the environmental action module (VI) which would follow the autonomous research project.

The Value Evaluation Component Worksheet - It is highly desirable to attempt to get some indication of the extent to which environmental research has modified the values of the student doing the research. This kind of evaluation is extremely difficult and many throw up their hands in horror at the thought of trying to do it. Even though it IS difficult and techniques are somewhat primitive, the authors strongly suggest making the effort.

There is a good deal of evidence to support the idea that values are, to some extent at least, a function of knowledge. If this is the case, we should be able to get some indication of values modification as a function of doing autonomous research in environmental problems.

It is felt that the student will often communicate one set of values and operate from another, somewhat different, set of values. Naturally, the set of values on which a human being ACTS is the most important of the two. However, it is usually difficult to make those observations which would permit the instructor to determine the students' values with respect to their environmental behavior. Instead, at least presently, we must often be content to get some perception of the values which the student is willing to communicate to another individual.

The writers have developed a one page evaluation worksheet with the intent of getting both pretest and posttest data concerning students' values. This worksheet is located at the end of this guide and may be duplicated for use with the instructor's classes. It is recommended that all of it be reproduced except for the heading (further, if the students are sophisticated with the business of being used for research, the teacher may wish to also remove the "pre" and "post" aspects of the worksheet).

This worksheet should be administered immediately upon the student's completion of the research question during autonomous research. At this point he knows what it is he is going to research, but he has little new knowledge affecting his perceptions of this problem area. The post can be administered immediately upon the successful termination of the project - at a time when the research report has been finalized or after the student has made a research report to the class.

Student responses on the worksheet can be compared, pre to post, for signs of values modification. Of course, other signals or behaviors should be observed which will give the teacher some indication of what is going on in terms of the student's thinking. There are often many such verbal or action signals available.

VALUES EVALUATION COMPONENT - Module V

Pre_____
Post____ Student's Name_____

Date_____ Grade_____ Class/Period_____

RESEARCH QUESTION USED IN RESEARCH:

IMPORTANT: Please follow these instructions carefully; read and answer all questions with great care!

1. Why did you choose this particular problem to research? What IS the reason? Please DO NOT use phrases like, "I am interested in this problem." You are interested for a reason - just what IS that reason?

2. Your problem probably has importance for people in your community, region, or the entire world. Of what importance is this problem to people who live in the community, region, and/or world?

3. You are a citizen! What do you feel YOU should do as a citizen regarding this particular problem?

V-6. MY CONTRACT - Name _____

Class _____ Instructor _____

Final Research Question:

I hereby contract with my instructor and further guarantee that I shall use all of my mental ability and those skills in which I have been trained in order to successfully investigate the problem chosen and the research question stated above. Further, I guarantee that my independent investigation will be conducted in a manner as to give me pride in myself and to respect the rights of other human beings.

I understand that my research will be evaluated on a raw-score basis and that my final grade for this project will be based on the number of points earned. Further, I have read the following breakdown of possible points and understand how I will be evaluated.

Criteria	Points	Points Awarded
Quality of research question	10	_____
Strategy (techniques) used in investigation	20	_____
Seriousness of approach to research	10	_____
Quality of data collected	20	_____
Accuracy of conclusions	20	_____
Excellence of inferences	20	_____
Accuracy and organization of final report	25	_____
Class presentation	25	_____
Grand Totals	150	_____

_____
Signature of Student

_____ _____
Date Signature of Instructor

_____
Signature of Witness

OBJECTIVES FOR MODULE VI

Module VI - Environmental Action Strategies

In Module VI students are introduced to the basic elements of environmental action. They first define positive, negative and passive action, propose examples of each type and then defend their choices. They are introduced to the difficulty in classifying actions due to divergence of opinion on personal rights and the effects of particular actions on the environment. Students are then introduced, in detail, to specific modes of action, i.e., persuasion, consumerism, political action and ecomanagement. A discussion of individual and group action effects and catagories of group action follows this discussion. Students are presented with a list of thirteen action analysis criteria which should be considered before taking any form of environmental action. Further, they apply these criteria to a specific example of environmental action. Finally, the students are given an opportunity to apply all of the action skills and knowledge to develop a plan for action concerning an environmental issue. They identify and summarize the issues, identify and evaluate possible actions and make a final recommendation concerning action on the issue.

Specific Objectives: As a function of Module VI the students will be expected to be able to . . .

VI-1. . . . define positive, negative, and passive environmental action.

VI-2. . . . identify two or more reasons why it is difficult to classify a particular environmental action as passive, positive, or negative.

VI-3. . . . propose one example of an environmental action which could be classified as either positive or negative and defend both of these classifications.

VI-4. . . . define the action method of PERSUASION and identify at least two examples of strategies which could be used in this category.

VI-5. . . . define the action method of CONSUMERISM and identify at least two examples of strategies which could be used in this category.

VI-6. . . . define the action method of POLITICAL ACTION and identify at least two examples of strategies which could be used in this category.

VI-7. . . . define the action method of ECOMANAGEMENT and identify at least two examples of strategies which could be used in this category.

VI-8. . . . identify two advantages of group action which individual action cannot accomplish.

VI-9. . . . identify at least three categories of group action and name one organization which represents each category.

VI-10 . . . explain why an individual should consider each of the thirteen action analysis criteria before taking any type of environmental action.

VI-11 . . . when given a specific example of an environmental action, apply the thirteen action analysis criteria and provide logical answers to each of the thirteen questions.

VI-12 . . . identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

VI-13 . . . produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows the appropriate guidelines for persuasive action.

VI-14 . . . describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

VI-15 . . . list the three stages leading to environmental action at which persuasive action may be aimed.

VI-16 . . . identify three different modes of persuasion and explain how each can best be put to use.

VI-17 . . . select a product and perform both an ENVIRONMENTAL COST and a NEEDS ASSESSMENT on the product. Further, recommend as to whether action should be taken regarding the product.

VI-18 . . . identify three categories of consumer action and describe issues in which each form of action is appropriate.

VI-19 . . . describe three kinds of political action and discuss how each of them may be effectively applied to environmental issues.

VI-20 . . . identify three situations in the local area which could require ecomanagement type actions.

VI-21 . . . apply all of the action skills and knowledge in developing a plan for action concerning some environmental issue. This would include identifying and summarizing the issue, identifying and evaluating possible actions, and making a final recommendation concerning action on the issue.

Suggestions for Teaching Module VI

Module VI introduces students to most of the basic strategies inherent in environmental action. The mode of legal action was purposefully not covered in the modules. Up to this point in these modules, the students have been engaged in activities revolving around identifying environmental problems and methods of securing information regarding those problems. This module exposes them to the array of actions they might use to help bring resolution to those problems. The advantages and disadvantages of persuasion, consumerism, political action and ecomanagement are discussed and students are given the opportunity to engage in surrogate activities involving each of these action modes.

Throughout this module, students are presented with examples of both positive and negative activities in response to environmental degradation. Both types of activities should be explored and the ramifications and responsibilities of such behaviors should be discussed, weighed, accepted, and/or rejected. The module is geared to challenge the students' abilities of synthesis, analysis, and evaluation rather than base recall and memorization.

The module offers suggestions for real environmental action projects and it should be used with that end in mind. The authors recognize the tremendous significance of students being involved in environmental action projects and recommend this procedure as the culminating module activity. The authors realize that it is both unfair and unethical to demand that citizen action be taken in a student role. However, it is hoped that students would be willing to take such action by virtue of their interaction with the information in Module VI. Similarly, it is hoped that their specific action decisions will be supported and assisted by their instructor. For environmental awareness without subsequent positive action is of little personal or societal value.

Any action which an individual takes is motivated by the values which he/she carry within them. This holds true also for environmental situations. In this module students are asked to make decisions regarding the quality of exemplified types of environmental action. Although value clarification activities per se are not utilized in this module, students must apply their own values to a number of value laden action situations.

There is a growing body of research data which indicates that knowledge has a direct bearing on value formation and value change. Students possessing greater amounts of environmental information also seem to be more willing to communicate and defend their values. It would seem logical then, as you progress through module activities to supplement the students' knowledge base with additional, valid information. The beneficial results of accurate, ecologically sound information in value formation must not be underestimated.

As with previous modules, the authors have attempted to describe each major action mode and present general guidelines for each action strategy. No attempt has been made to establish models for every strategy presented. At times, by virtue of the nature of the material, the student has not been presented with an opportunity to fully apply the strategy in an actual

situation. It is the hope of the authors that instructors using this module will assess their students and develop such models and application opportunities as determined by each specific situation.

Classifying Environmental Actions, I-1, I-2, (pages 134-135-SM). In exercise I-1, most students will decide that the commonality of the specific actions described rests in their being negative or detrimental behaviors toward environmental quality. Not all students may see this, due to disagreement about their personal rights and the effects of specific actions on the environment. It is recommended that students discuss their rationale concerning negative, positive and/or neutral stances toward each exemplified behavior. The discussion should bring out differing value constructs. This is healthy, for within differences lies the crux and origin of environmental problems and diversity of behaviors. Do not expect instant conversion of those students who do not see the negative ramifications of certain behaviors. Hopefully this will come in time as they receive further exposure to decision-making regarding environmental issues. Unfortunately, but also realistically a few children will never accept certain behaviors as completely negative or positive. Such is the way of human nature as influenced by our value inculturation and level of knowledge concerning the environment. In fact, although frustrating for the teacher, it may be therapeutic to have dissident opinions expressed in class for they can serve to strengthen existing positive value constructs.

The values of the authors exhibit themselves in regard to the classification of actions in exercise I-2. Item 1-6 are considered - negative actions-. The responses to items 3 & 4 should elicit discussion in terms of personal rights versus environmental degradation. Action 5 can lead to a discussion of the national problem of garbage buildup, removal, costs, etc. The topic of landlords' services to rental property and rentor responsibilities to his home or business also are cogent here. In Action 6, the teacher may have to point out the problem caused by the lack of desintegration of aluminum and the subsequent effects this will have on the flora and fauna of the lake.

Action 7 - + classification. Here the defense rests in the long term benefits of composting to enrich the soil. The odor is a short term nuisance which can be circumvented by proper construction of a compost pile. Application of lime usually deters odor, accelerates decomposition and adds mineral nutrients to the organic material.

Actions 8, 9, and 10 - answers will vary. In item 8, students might contrast the inefficiency of pollution devices in terms of increased gas consumption to the depletion of fossil fuel reserves. The dangers of air pollution is another contributing variable. Each is a legitimate position - a matter of values. In item 9 - hopefully students will point out the double edged sword of extraneous water use in contrast to electric consumption to keep water cool. (see pp. 229-231 of the Earth Tool Kit, Pocket Books, New York, 1971 for a listing of average wattages of common household appliances.)

Item 10 - The advantages of zero population growth and its effect on food supplies and available space, psychological stress etc. can be compared to religious and home life values. The emotionally positive effects of children may be based on societal rationalization rather than empirical evidence.

In many of the above items, especially 8, 9, and 10, no concrete knowledge base exists from which values can be developed. It should be pointed out to students that, in many cases, their decisions should be tentative until more knowledge is available. As knowledge is gained, individuals can then behave consistently with desirable environmental goals.

The authors would recommend that you allow rational and disciplined arguments to take place in class. In fact, after you have covered the Action Analysis Criteria (page 144-SM), it is recommended that you return to these activities and apply the criteria to each of these situations so that students may evaluate the actions again, in a new light.

The anecdote entitled "Negative or Positive" on page 136-SM may elicit both positive and negative responses. It presents fertile ground for the instructor to emphasize the divergence of opinions and actions due to differing value constructs as well as an analysis of Lovejoy's actions when compared to the thirteen action analysis criteria.

American Bison Photo (page 133, SM) - Although the photograph of the American bison does not carry a caption, it can be pointed out to the students that this animal's survival is a function of environmental action which was taken after 1900. The only reason that the bison survives today is because a handfull of concerned Americans were willing to use their skills and time to insure a number of refuges for the "buffalo". You might suggest that this action drama be researched and reported on in class.

The Environmental Action Model (pages 137-142, 144-SM) - This action model is presented to both teachers and students as an interpretation of the ultimate goal of environmental literacy - that of overt, positive environmental action. The model contains three major components. The first component is a categorization of the major action elements. These are persuasion, consumerism, political action, legal action and ecomanagement. All specific environmental actions can be classified as one of these major types. Although many authors of environmental education literature discuss one or more of these action components, this model is the only extant treatment of all categories of environmental action melded with an explanation of the levels at which these actions can take place.

You will find that legal action is depicted in the model articulation chart on page 140-SM. The authors have chosen not to present the students with instruction on legal action because they feel that middle school students would not be able to successfully accomplish legal action at this point in their lives.

The second component of the Action Model is the identification of the levels at which action takes place. Action may be taken by an individual or by groups of individuals at various geographic levels, i.e., county, state, national, international, etc. The merit of establishing levels of action lies in the concept that the scope of concern and the scope of effectiveness

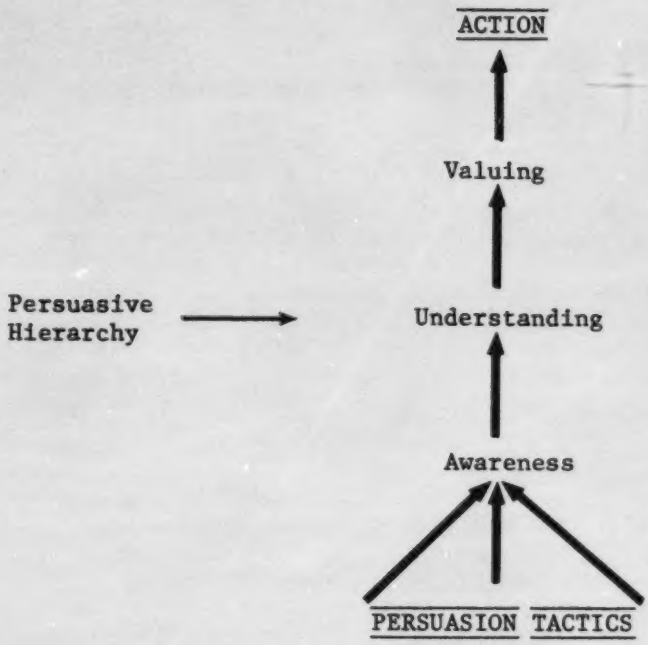
(power) of actions usually increases as these actions are taken by groups at higher organizational levels (see page 140-SM). It is not intended to communicate that actions should take place at only high levels of organizational structure. Actions do and should take place at all levels. The model should serve only as an analysis guideline of scope and effectiveness when specific actions are chosen for particular environmental problems. For example, an effective anti-litter campaign might be accomplished at the community level whereas a campaign for the protection of an endangered plant species might necessitate action at a regional or state level.

The third component of the Action Model is the establishment of thirteen action analysis criteria (see page 144-SM) which should be applied by an individual to an environmental action prior to his taking that action. These criteria are phrased as questions. The answers to these questions are important guideposts which aid in the determination of the most appropriate action mode to be taken. In discussing these criteria with you students, it is necessary to stress that any action taken should be the result of an ethical, ecologically sound decision if the criteria are appropriately applied.

Exercises VI-3, VI-4, VI-5 (pages 141 - 145-SM) engage the students in establishing criteria for environmental action decision-making, applying action analysis criteria to each of the four action modes and applying the criteria to a specific environmental action strategy. In the first activity, the students should compare their own guideposts to the list of criteria posed on page 144-SM. If new and useful criteria come out of this activity, they should be added to the thirteen found in the module. In Exercise VI-4, it should be pointed out that all the criteria are pertinent to all four modes of environmental action. It is presumed that, in exercise VI-5, the students will decide not to proceed with toppling the tower. Such an action would not be ethical and it would have negative legal and social consequences. It might prove interesting to explore alternatives that Mr. Lovejoy might have taken.

Persuasion as an Environmental Action. Persuasive action may exist alone as a means of effecting a solution to a problem. More often, however, persuasive action techniques play a role in other action modes. For this reason, persuasion is the first action mode discussed in detail for the students. Persuasive approaches are identified as being logical, emotional, and coercive. Although coercion is considered to be a tactic of force rather than true persuasion, it is mentioned in Module VI because it is a technique used by environmentalists (usually in a legal context) to assure that positive action is taken. Coercion in the form of threats, intimidation, violence, etc. is dangerous and unethical. It is also ineffective once the external force is removed. Persuasion is most effective when the techniques used bring about an internalized behavior change.

Persuasion strategies can function at three levels within an individual. These levels are awareness, understanding, and valuing. These levels can exist in a hierarchical arrangement and this is diagrammed as follows:



Although all levels are important and related to each other, for a persuasive technique to be ultimately effective it must bring about a change in the values of individuals so that they prize and choose to take action.

Eutrophication is discussed on pages 150-151-SM. It is important to note that eutrophication is a normal and natural aging process which takes place in bodies of water. Eutrophication becomes an environmental problem when specific factors such as phosphates increase the normal rate of the eutrophication process. Nutrients such as phosphates and nitrates simply contribute to excessive plant growth. Eventually, large numbers of water plants die which results in abundant decay. The decay process demands a great deal of oxygen which results in oxygen depletion in the water. If the oxygen level gets low enough so that aquatic animals can no longer survive, the situation is complicated by the death of populations of animals. This, of course, leads to more decay and a most serious situation.

The guidelines for persuasive action (page 152-SM) should be stressed with the students. The thirteen action analysis criteria listed on page 144-SM may yield further guidelines which could be added to those presented in the text.

Classifying Actions VI-6 (page 153-SM) involves the students in analyzing the actions of two different environmental activists on a logical, emotional and coercive basis. The defense of the students' analysis is most important. It is an opportunity to reinforce the use of the guidelines for persuasive action discussed earlier.

Further activities in persuasive action techniques are left to the discretion of the instructor. Some suggestions are:

1. Students can identify the types of persuasive approaches (logical, emotional) used in television and radio commercials, newspaper and magazine advertisements, etc. Identification of the value positions depicted would be valuable. The persuasive techniques used by petroleum corporations, utility companies, and other special interest groups are particularly interesting.

2. Students can prepare a persuasive tactic of their own choosing first a logical approach and then modifying it to depict an emotional approach. A student might want to combine the two types. This tactic might be presented in class. The topic which the students autonomously researched in Module V might be most appropriate for this activity.

3. An exercise using a debate strategy is viewed by the authors as very powerful. The instructor may need to model appropriate behaviors here since debate, although effective, is not a common strategy in the classroom. Some debate questions which offer opposing positions are:

   a. Should predator control measures include the use of cyanide?

   b. Should the supersonic transport (SST) be banned worldwide?

   c. Is abortion an acceptable population control method?

   d. Should controlled alligator hunts be allowed in Louisiana and Florida?

   e. Should automobile pollution control regulations be relaxed in order to conserve fossil fuels?

Consumer Action is an effective method of action for individuals and groups. The strategies of direct boycotting and consumer conservation are rather clearcut. Indirect boycotting is more difficult to conceptualize in that it is a persuasive consumer action directed at bringing about a change that is related to a product but not a change in the product itself. The indirect boycotting of Japanese goods did not eliminate the use of whale oil but it did effect a change in the manner in which whales were hunted--a manner which could have severely endangered certain whale populations if left unchecked. Indirect boycotting is often used with non-environmental issues. Consumers have boycotted South African goods and services in an attempt to change the treatment of the black populations in that country.

The type of consumer action taken not only depends on the environmental issue. It also depends upon a careful appraisal of the environmental costs and consumer needs of the product in question. In this module students are introduced to an environmental cost-needs assessment regarding metal pop cans. The pop can issue can serve as a model of performance for the students as they engage in cost-needs assessments on products of their choice. The

instructor should have the students closely inspect the types of questions posed in the assessment. Manufacture, transport and disposal costs are explored as well as the basic costs of materials, environmental damage and environmental repair. If the instructor should choose to have the students carry out another cost-needs assessment so that they gain experience in the technique, caution the students to explore all avenues of need and cost and to generate appropriate questions regarding the product. Cost-needs assessments are not, however, an end in themselves. They are merely the vehicle which an individual or groups of individuals use to determine the appropriate consumer action to be taken. Applying cost-needs assessments requires students to use the research skills they learned in previous modules. The instructor should allot adequate time for such research to take place.

In Exercise VI-7 (page 157 SM) students are given the opportunity to complete a needs assessment in regard to pop can use. Encourage the student to apply the guidelines for assessing product need in the exercise. The determination of real or imagined need and the environmentally desirable substitute available may be relatively easy tasks. However, the question of valuing the benefits of the product more than the costs to the environment is a heady one and is often answered emotionally. Objectivity on the part of the students and instructor are imperative when applying the guidelines for assessing need.

Consumer conservation is identified in Module VI as a consumer action. Some students may recognize that consumer conservation is a form of ecomanagement. This is indeed the case. However, since ecomanagement also includes many non-consumer related tactics, it is treated as a more encompassing action mode of which consumer conservation is just one facet.

As a final activity for the consumer action phase of this module, it is recommended that students apply cost-need assessments to various products and subsequently debate the need for action. As groups or individuals, they can then plan types of consumer action which might be used. Some students may also incorporate persuasive actions along with consumer tactics. If the actions chosen are appropriate ones, the students should be encouraged to do so.

<u>Political Action</u> encompasses such activities as voting, campaigning and lobbying. Each of these specific actions contain elements of persuasive action. If an environmentalist chooses to campaign for a political candidate, he is in fact employing persuasion tactics to convince individuals to vote in a certain way. Political action, then, involves knowing how, when, and where to apply persuasion. This necessitates taking an active part in the decision-making process inherent in the political structure at local, state and national levels.

This portion of Module VI only attempts to make students aware of the elements of political action. It is not designed to give students the intricate steps of political decision-making. It is left to the instructor to help the students to learn about the local and state political structure (if this is deemed desirable). The procedures of the law making process

might be examined so that students are aware of the points in this process where political action can be taken. Such legislative information can be taught by the social studies teacher in a team teaching arrangement.

In order for students to become successful politica' activists, they need to be well informed. Public news media (radio, television, newspapers) should be utilized so that students become aware of the environmental values of political candidates and the important issues that are currently being considered by government. Environmental organizations such as the Sierra Club and the National Wildlife Federation are other important sources of information. The authors of the modules have listed a wide array of such organizations and their addresses on pages 42-44SM in Module II.

If students become interested in joining environmental organizations, they need to carefully select the groups in which they become active. Considerations for joining organizations include:

1. Are the goals of this organization consistent with my environmental values?

2. Are the actions which this organization employs ethical as well as effective?

3. Am I willing to commit myself to the goals and actions of the organization?

4. Of what value will my membership in this organization be to myself and to the group?

Your students may very well develop other considerations and should be encouraged to do so.

No specific activities are presented to the students regarding political action. Some interesting activity ideas which the instructor can use at this point in the module are:

1. Students can develop a set of environmentally appropriate guidelines for voters to use in selecting candidates for which to vote.

2. Students can prepare a list of ways in which every voter can remain informed on the candidates and the issues.

3. Students can evaluate a candidate's past congressional voting record and determine whether the candidate has used an environmental ethic in political decision-making.

4. Students can select a specific environmental issue and an appropriate political official and compose an effective letter urging that specific actions be taken.

Ecomanagement involves actual physical manipulation of the environment in order to improve its quality. Ecomanagement projects are direct action and can serve also as persuasive modeling behaviors for other individuals.

As individuals become interested in taking an ecomanagement form of action, they should again assess their action choice by using the thirteen action analysis criteria. In ecomanagement activities, criteria #13 (What are the ecological consequences of this action?) should be specially considered. For example, if students attempt a full scale newspaper recycling project, they should carefully assess the type of collection method they use. If they were to use a large truck for door to door collection, the environmental costs from air pollution and fuel use might surpass the environmental gain from recycling the papers.

In Exercise VI-8 (page 161SM) the responses will vary for each teaching situation. The authors realize that the list is not all inclusive. In fact, it is strongly suggested that the instructor consider involving his/her students in an ecomanagement needs assessment within the community. After a thorough survey of such needs, the students could then select an ecomanagement project and again apply the thirteen action analysis criteria to determine the appropriate strategy to follow in the project. Perhaps several groups could use the same or different issues and compare recommendations. It is hoped that the students would ultimately wish to carry out the action.

Applying Environmental Action Skills presents the students with a model in which action and investigation skills are applied to a particular environmental problem. The model provides sample responses to the thirteen action analysis questions. These responses should help students see how these criteria help determine the viability of a chosen action and direct the decision-making process.

Few environmental actions which are taken can be clearly classified as being one specific type of action mode. In reality, an action plan and the subsequent action will probably be a combination of several action modes. For example, an ecomanagement project may incorporate persuasion and consumer tactics as well as a direct physical action. Previous to this section, students have been exposed to the action modes as semi-isolated entities. It should be emphasized that action plans should synthesize those action modes which are most appropriate to the environmental problem in question. As always, the thirteen action analysis criteria should be applied whether a single mode or a combined action strategy is being contemplated.

Exercise VI-9 (page 166SM) requires students to develop an action plan on a problem of their choice. It is recommended that they use the topic which they investigated during the autonomous research phase of the modules.

The instructor must establish his/her expectations for the final product (needs assessment; selection and evaluation of action) and explain the final reporting format to the students. The form used in pages 163-166 SM is recommended. However, the authors would expect the data and discussion sections to be more detailed and lengthy than those which were abbreviated in the model. If students wish to work together on action plans, they should be allowed to do so.

An ending note to this module seems pertinent. The anecdote on page 166 SM is a true one. Students can and do actually carry through with environmental action. Although we, as authors, cannot demand that your students DO take action, we haope that they will autonomously choose to do so. The purpose of this module is to give students the action skills necessary to accomplish the task. In the final analysis, we hope that knowledge of action skills will encourage them to become citizens who are not only environmentally aware but who are environmentally active.

Appendix A

The absence of a module dealing with the experimental technique is not unintentional on the part of the authors. First, the authors' experience teaching middle-school students tells them that at least 90% of the students will choose other modes of investigation when they have an opportunity to choose from all available alternatives. Second, most of the variables that middle-school students or anyone else would have to deal with in environmental education are extremely difficult to recognize and control properly in a laboratory situation. Third, those variables that are workable in a laboratory situation require sophisticated equipment that is not readily available in most public schools.

About this time you are probably in a panic saying, "yes, but what do I do with the 10% of the student population that may choose a problem requiring the experimental technique?". DON'T PANIC! First cover the first four modules thoroughly and carefully. Second, when your students select their problem areas in Module V, identify those students who choose a problem that requires experimentation and variable manipulation. (NOW, PANIC!)

At this point, either in small groups or individually, explain what an experiment is by relating it to the nature of the problem areas they have chosen. Next, either in small groups or individually, explain what the components of an experiment are, the importance and function of each. You may want to use the following model for your explanation or perhaps better yet, you will relate each component to one or all of the problems chosen by the students.

Components of An Experiment

> Experiment: An experiment is nothing more than the planned process of making something happen under conditions controlled by the experimenter. An experiment is actually a situation planned and set up by the experimenter, which will give him the answer to a specific question, because all other conditions or possibilities have been eliminated.[1]

An experiment usually (not always) begins with a question that has resulted from the observation of some discrepant event that occurred at a particular time under observable circumstances. For instance, the question, "What is responsible for dead fish and large algae blooms in polluted streams and ponds?", may have resulted when someone noticed that large algae blooms and dead fish occur in streams and ponds that receive large quantities of detergents and/or agricultural fertilizers. Consequently, the experimenter designs an operation that will allow him to answer the question(s) posed as a result of his observations. The experiment designed by the experimenter should consist of the following seven components:

[1]Philip Goldstein, How To Do An Experiment. (Chicago: Harcourt, Brace and World, Inc., 1957), p. 37.

COMPONENT	MODEL COMPONENT
I. Problem Component Rationale: Without a problem to solve, there is really no need for experimental investigation. When a problem is present, it should be communicated clearly and concisely.	I. Statement of the Problem: Large algae blooms and dead fish appear in some polluted streams and ponds.
II. Question Component Rationale: The question allows us to guess or hypothesize a logical outcome should we go ahead and experiment to try to find out what is causing the problem in streams that are polluted.	II. Statement of the Question(s) What variable is responsible for dead fish and large algae blooms in polluted streams and ponds? Variable: Any "factor" that is likely to effect the outcome of the experiment e.g. temperature of water, kind of fish present, kind of algae present.
III. Hypothesis Component Rationale: The hypothesis gives us something precise on which to base an experiment. The hypothesis must identify exactly what it is we are testing. The thing to be tested is called the EXPERIMENTAL VARIABLE. This becomes the one variable around which the whole experiment is designed.	III. Statement of the Hypothesis(es) It appears as though streams and ponds that have large algae blooms and dead fish are also streams that receive large quantities of detergents and/or agricultural fertilizers. Phosphorous is found in large quantities in some detergents and in many agricultural fertilizers. Consequently, we guess (hypothesize) that chemical compounds containing phosphorous are responsible for the dead fish and large algae blooms in streams and ponds. Experimental Variable: Phosphorous (Phosphates)

IV. Experimental Design Component Rationale: This part of the experiment produces a technique which will probably yield good, scientifically accurate data. Actually, this part of the experiment guides the scientist in his search (or in the testing of his hypothesis). You will note that everything in this design is constant. This means that ALL variables are carefully controlled EXCEPT one - the experimental variable. This is of critical importance because our experimental variable is phosphates - we must be able to determine whether phosphates are, in fact, responsible. Therefore, only the amount of phosphates in each pond will be allowed to vary!!	IV. Experimental Design: We design an experiment which will test what happens when algae and fish are exposed to various quantities of phosphates. This could be done in several ways. A number of similar outside ponds could be constructed to be used for this purpose. It is, however, absolutely necessary that the ponds ARE similar in all respects. We then would plan to introduce given quantities of algae and fish into EACH separate pond. Following this, we would place different amounts of phosphates in each pond and over time critically observe the results of this strategy. One pond would receive NO phosphates! This pond would be called our control pond.
V. Investigation and Data Collection Component: This part of the experiment follows the experimental design exactly! If the design is valid then this step will guarantee scientifically accurate data. Measurements taken must be exact and recorded in a manner that will be completely accurate.	V. Investigation and Data Collection: Here we actually DO the experiment. Ponds are built, water added, fish and algae in exact amounts are added to each pond. Varying, measured amounts of phosphates are added to each pond (EXCEPT the control pond). Observations are made over time. These observations are recorded accurately.

VI. Data Reporting Component: Rationale: The scientist is ethically obligated to report his findings to other scientists for examination. Consequently, the data collected must be accurately reported and organized in a logical, orderly manner.	VI. Data Reporting: In this part of the experiment, the experimenter organizes his data for reporting. This organization and reporting can use any logical means of communication. Included can be charts, tables, graphs, and simple paragraph summaries.
VII. Conclusions, Inferences, and Recommendations: Component Rationale: Data interpretation.	VII. Conclusions, Inferences, and Recommendations: Refer to Module IV.

Note: If the above model was to be implemented as it exists one would certainly run into some serious research validity questions. It is entirely possible that the experiment could be successfully conducted and the hypothesis accepted. This would be one of those cases in science when a successful experiment was conducted on the wrong inference (hypothesis). Why?

Phosphates are not directly responsible for dead fish following an algae bloom. The relationship is an indirect relationship in that the nutrients simply produce an environment in which plants grow and reproduce excessively. This excessive growth is followed by the death and decay of an inordinate number of plants. The decay process demands huge amounts of oxygen. This results in oxygen depletion. It is, therefore, largely a lack of sufficient oxygen that causes the fish to die. Thus, one perceives that the original hypothesis was actually inaccurately generated and stated.